Government of Western Australia
School Curriculum and Standards Authority

PHYSICS

GENERAL COURSE

Year 12 syllabus

IMPORTANT INFORMATION

This syllabus is effective from 1 January 2017.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the School Curriculum and Standards Authority on a cyclical basis, typically every five years.

2013/44333v4

Content

Rationale

Physics is a fundamental science that endeavours to unlock the mysteries of the universe and provides the foundation of understanding upon which modern technology is based. It uses a comparatively small number of assumptions, models, laws and theories to explain a wide range of phenomena, from the incredibly small to the incredibly large. Students investigate how the unifying concept of energy explains diverse phenomena and provides a powerful tool for analysing how systems interact. Students learn how an understanding of physics is central to identifying and finding solutions to some of the key issues facing an increasingly globalised society.

The Physics General course involves practical investigations, tasks incorporating logical and analytical thinking and the communication of scientific information and ideas. Studying the Physics General course will enable students to become citizens who are better informed about the world around them, and who have the critical skills to evaluate and make decisions based on scientific evidence about current issues.

Aims

The Physics General course aims to develop students':

- comprehension of the fundamental concepts and principles of physics
- skills of logical thinking and ability to use these skills to solve problems
- appreciation of the significant contribution physics has made to society
- understanding of the ways in which matter and energy interact in physical systems
- understanding of how physics knowledge is used in a wide range of local and global contexts
- investigative skills, including the design and conduct of investigations, the collection and analysis of data, and the interpretation of evidence
- use of the language and conventions of physics to develop skills in communication.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 12 syllabus is divided into two units which are delivered as a pair. The notional time for the pair of units is 110 class contact hours.

Unit 3 – Moving

The focus of this unit is the behaviour of moving bodies. Students explore the effect of forces in generating movement and the transfer of energy.

Students apply physics concepts to their understanding of how people and objects move in sport, fun parks and vehicle safety.

Students use science inquiry skills to explore the behaviour of objects, collecting data using a variety of methods, analysing data and drawing evidence-based conclusions. They relate data and apply principles to real situations. Practical activities offer students valuable opportunities to plan investigations, make careful observations, operate equipment in a safe and organised manner, and work with others.

Unit 4 – Electricity

The focus of this unit is electricity as a form of energy and how it behaves in materials. The principles are applied to develop students' understanding of the use of electricity in today's society.

The production and use of electricity is vital to our lives. It needs to be managed safely and used efficiently. Students explore the application of electricity in a range of contexts.

Practical activities offer students valuable opportunities to make careful observations, operate equipment in a safe and organised manner, and work collaboratively. Students construct simple electrical circuits and safely collect data using measuring devices. Students plan and conduct investigations, and use their scientific understanding to answer real-world questions and make evidence-based decisions.

Each unit includes:

- a unit description – a short description of the focus of the unit
- unit content – the content to be taught and learned.

Organisation of content

Science strand descriptions

The Physics General course has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding. The three strands of the Physics General course should be taught in an integrated way. The content descriptions for Science Inquiry Skills, Science as a Human Endeavour and Science Understanding have been written so that this integration is possible in each unit.

Science Inquiry Skills

Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. This strand focusses on evaluating claims, investigating ideas, solving problems, reasoning, drawing valid conclusions, and developing evidence-based arguments.

Science investigations are activities in which ideas, predictions or hypotheses are tested, and conclusions are drawn in response to a question or problem. Investigations can involve a range of activities, including experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations. The investigation design will depend on the context and subject of the investigation.

Science as a Human Endeavour

Science concepts, models and theories are reviewed as their predictions and explanations are continually re-assessed through new evidence, often through the application of new technologies. This review process involves a diverse range of scientists working within an increasingly global community of practice.

The application of science may provide great benefits to individuals, the community and the environment, but may also pose risks and have unintended consequences. As an ever-evolving body of knowledge, science frequently informs public debate, but is not always able to provide definitive answers.

Science Understanding

Science understanding is evident when a person selects and integrates appropriate science concepts, models and theories to explain and predict phenomena, and applies those concepts, models and theories to new situations.

The Science Understanding content in each unit develops students' understanding of the key concepts, models and theories that underpin the subject, and of the strengths and limitations of different models and theories for explaining and predicting complex phenomena.

Safety

Science learning experiences may involve the use of potentially hazardous substances and/or hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students and that school practices meet the requirements of the *Work Health and Safety Act 2011*, in addition to relevant state or territory health and safety guidelines.

Animal ethics

Through a consideration of research ethics as part of Science Inquiry Skills, students will examine their own ethical position, draw on ethical perspectives when designing investigation methods, and ensure that any activities that impact on living organisms comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th edition 2013* (www.nhmrc.gov.au/guidelines/publications/ea28).

Any teaching activities that involve the care and use of, or interaction with, animals must comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th edition 2013*, in addition to relevant state or territory guidelines.

Information regarding the care and use of animals in Western Australian schools and agricultural colleges can be viewed at www.det.wa.edu.au/curriculumsupport/animalethics/detcms/portal/

Mathematical skills expected of students studying the Physics General course

The Physics General course requires students to use the mathematical skills they have developed through the Year 7–10 Mathematics curriculum, in addition to the numeracy skills they have developed through the Science Inquiry Skills strand of the Science curriculum.

Within the Science Inquiry Skills strand, students are required to gather, represent and analyse numerical data to identify the evidence that forms the basis of their scientific arguments, claims or conclusions. In gathering and recording numerical data, students are required to make measurements using appropriate units to an appropriate degree of accuracy.

It is assumed that students will be able to:

- perform calculations involving addition, subtraction, multiplication and division of quantities
- perform approximate evaluations of numerical expressions
- express fractions as percentages, and percentages as fractions
- calculate percentages
- recognise and use ratios
- transform decimal notation to power of ten notation
- substitute physical quantities into an equation using consistent units so as to calculate one quantity and check the dimensional consistency of such calculations
- solve simple algebraic equations
- comprehend and use the symbols/notations $<$, $>$, Δ, $\approx$
- translate information between graphical and numerical forms
- distinguish between discrete and continuous data and select appropriate forms, variables and scales for constructing graphs.

Representation of the general capabilities

The general capabilities encompass the knowledge, skills, behaviours and dispositions that will assist students to live and work successfully in the twenty-first century. Teachers may find opportunities to incorporate the capabilities into the teaching and learning program for the Physics General course. The general capabilities are not assessed unless they are identified within the specified unit content.

Literacy

Literacy is important in students' development of Science Inquiry Skills and their understanding of content presented through the Science Understanding and Science as a Human Endeavour strands. Students gather, interpret, synthesise and critically analyse information presented in a wide range of genres, modes and representations, including text, flow diagrams, symbols, graphs and tables. They evaluate information sources and compare and contrast ideas, information and opinions presented within and between texts. They communicate processes and ideas logically and fluently and structure evidence-based arguments, selecting genres and employing appropriate structures and features to communicate for specific purposes and audiences.

Numeracy

Numeracy is key to students' ability to apply a wide range of Science Inquiry Skills, including making and recording observations; ordering, representing and analysing data; and interpreting trends and relationships. They employ numeracy skills to interpret spatial and graphic representations, and to appreciate the ways in which physical systems are structured, interact and change across spatial scales. They engage in analysis of data, including issues relating to reliability and probability, and they interpret and manipulate mathematical relationships to calculate and predict values.

Information and communication technology capability

Information and communication technology (ICT) capability is a key part of Science Inquiry Skills. Students use a range of strategies to locate, access and evaluate information from multiple digital sources; to collect, analyse and represent data; to model and interpret concepts and relationships; and to communicate and share science ideas, processes and information. Through exploration of Science as a Human Endeavour concepts, students assess the impact of ICT on the development of science and the application of science in society, particularly with regard to collating, storing, managing and analysing large data sets.

Critical and creative thinking

Critical and creative thinking is particularly important in the science inquiry process. Science inquiry requires the ability to construct, review and revise questions and hypotheses about increasingly complex and abstract scenarios and to design related investigation methods. Students interpret and evaluate data; interrogate, select and cross-reference evidence; and analyse processes, interpretations, conclusions and claims for validity and reliability, including reflecting on their own processes and conclusions. Science is a creative endeavour and students devise innovative solutions to problems, predict possibilities, envisage consequences and speculate on possible outcomes as they develop Science Understanding and Science Inquiry Skills. They also appreciate the role of critical and creative individuals and the central importance of critique and review in the development and innovative application of science.

Personal and social capability

Personal and social capability is integral to a wide range of activities in the Physics General course, as students develop and practise skills of communication, teamwork, decision-making, initiative-taking and self-discipline with increasing confidence and sophistication. In particular, students develop skills in both independent and collaborative investigation; they employ self-management skills to plan effectively, follow procedures efficiently and work safely; and they use collaboration skills to conduct investigations, share research and discuss ideas. In considering aspects of Science as a Human Endeavour, students also recognise the role of their own beliefs and attitudes in their response to science issues and applications, consider the perspectives of others, and gauge how science can affect people's lives.

Ethical understanding

Ethical understanding is a vital part of science inquiry. Students evaluate the ethics of experimental science, codes of practice, and the use of scientific information and science applications. They explore what integrity means in science, and they understand, critically analyse and apply ethical guidelines in their investigations. They consider the implications of their investigations on others, the environment and living organisms. They use scientific information to evaluate the claims and actions of others and to inform ethical decisions about a range of social, environmental and personal issues and applications of science.

Intercultural understanding

Intercultural understanding is fundamental to understanding aspects of Science as a Human Endeavour, as students appreciate the contributions of diverse cultures to developing science understanding and the challenges of working in culturally diverse collaborations. They develop awareness that raising some debates within culturally diverse groups requires cultural sensitivity, and they demonstrate open-mindedness to the positions of others. Students also develop an understanding that cultural factors affect the ways in which science influences and is influenced by society.

Representation of the cross-curriculum priorities

The cross-curriculum priorities address the contemporary issues which students face in a globalised world. Teachers may find opportunities to incorporate the priorities into the teaching and learning program for the Physics General course. The cross-curriculum priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

Contexts that draw on Aboriginal and Torres Strait Islander histories and cultures, could provide opportunities for students to appreciate Aboriginal and Torres Strait Islander Peoples' understanding of physical phenomena, including the motion of objects, and astronomical phenomena, including Aboriginal constellations, their meanings and relationship with creation/Dreaming stories.

Asia and Australia's engagement with Asia

Contexts that draw on Asian scientific research and development and collaborative endeavours in the Asia Pacific region could provide an opportunity for students to investigate Asia and Australia's engagement with Asia. Students could examine the important role played by people of the Asia region in such areas as medicine, communication technologies, transportation, sports science and energy security. They could consider collaborative projects between Australian and Asian scientists and the contribution these make to scientific knowledge.

Sustainability

The cross-curriculum priority of Sustainability provides authentic contexts for exploring, investigating and understanding the function and interactions of physical systems. The Physics General course explores a wide range of physical systems that operate at different temporal and spatial scales. By investigating the relationships between systems and system components, and how systems respond to change, students develop an appreciation for the ways in which matter and energy interactions shape the Earth system. In exploring applications of physics knowledge, students appreciate that science provides the basis for decision making in many areas of society and that these decisions can affect the Earth system. They understand the importance of using physical science knowledge to predict possible effects of human and other activity, and to develop management plans, or alternative technologies, that minimise these effects and provide for a more sustainable future.

Unit 3 – Moving

Unit description

The focus of this unit is the behaviour of moving bodies. Students explore the effect of forces in generating movement and the transfer of energy.

Students apply physics concepts to their understanding of how people and objects move in sport, fun parks and vehicle safety.

Students use science inquiry skills to explore the behaviour of objects, collecting data using a variety of methods, analysing data and drawing evidence-based conclusions. They relate data and apply principles to real situations. Practical activities offer students valuable opportunities to plan investigations, make careful observations, operate equipment in a safe and organised manner and work with others.

Unit content

An understanding of the Year 11 content is assumed knowledge for students in Year 12.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- identify, research, construct and refine questions for investigation; propose hypotheses; and predict possible outcomes
- plan, select and use appropriate investigation methods, including preliminary trials, laboratory experimentation and controlling variables to collect reliable data
- assess risk and address ethical issues associated with these methods
- work collaboratively and individually to conduct investigations using appropriate measuring devices, safely, competently and methodically for the collection of valid and reliable data
- organise and clearly represent data in tables and appropriate graphs to identify trends, patterns and relationships
- describe sources of experimental error
- use appropriate SI units and symbols
- use evidence to make and justify conclusions
- evaluate conclusions by considering the quality of available evidence and make recommendations for improving experimental method
- communicate scientific ideas and information using appropriate scientific language, conventions and representations

Science as a Human Endeavour

- data used to describe motion can be collected using a range of technologies
- principles of physics can be applied to understand movement in sport

- traffic accidents can be investigated to determine how road and weather conditions, driver reaction times and speed affect the severity of vehicle collisions
- the principles behind safety measures, such as crash barriers, seatbelts, crumple zones
- the effects of friction in everyday life

Science Understanding

- displacement, velocity, speed , distance, momentum
- acceleration is the rate of change of velocity
- solve simple problems using the equations:

  $v = \frac{s}{t}, \quad a = \frac{v-u}{t}, \quad s = ut + ½\, at^2, \quad v^2 = u^2 + 2as, \quad p = mv$
- uniform motion in one dimension can be represented graphically
- forces and their effects, including pushes and pulls
- contact forces, including friction; and non-contact forces, including gravity
- forces have magnitude and direction
- free body diagrams show the forces acting on objects in one or two dimensions
- Newton's First Law (also called the law of inertia)
- Newton's Second Law explains the relationship between force and rate of change in momentum according to the equation $Ft = \Delta p = m(v-u)$
- Newton's Second Law also relates force and acceleration according to the equation *F = ma*
- the relationships above can be used to explain behaviour of objects in practical situations
- Newton's Third Law of motion
- the force of gravity causes objects close to the Earth to accelerate at the same rate
- distinguish between mass and weight. This will include applying the relationship:

  $F_{weight} = mg$
- objects in free fall due to gravity experience apparent weightlessness
- work done is equal to energy transferred. This will include applying the relationship:

  $W = Fs$
- kinetic energy is the energy of motion
- gravitational potential energy is the energy of position
- conservation of energy

Unit 4 – Electricity

Unit description

The focus of this unit is electricity as a form of energy and how it behaves in materials. The principles are applied to develop students' understanding of the use of electricity in today's society.

The production and use of electricity is vital to our lives. It needs to be managed safely and used efficiently. Students explore the application of electricity in a range of contexts.

Practical activities offer students valuable opportunities to make careful observations, operate equipment in a safe and organised manner, and work collaboratively. Students construct simple electrical circuits and safely collect data using measuring devices. Students plan and conduct investigations, and use their scientific understanding to answer real-world questions and make evidence-based decisions.

Unit content

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

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- plan, select and use appropriate investigation methods, including preliminary trials, laboratory experimentation and controlling variables to collect reliable data
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- work collaboratively and individually to conduct investigations using appropriate measuring devices, safely, competently and methodically for the collection of valid and reliable data
- organise and clearly represent data in tables and appropriate graphs to identify trends, patterns and relationships
- describe sources of experimental error
- use appropriate SI units and symbols
- use evidence to make and justify conclusions
- evaluate conclusions by considering the quality of available evidence and make recommendations for improving experimental method
- communicate scientific ideas and information using appropriate scientific language, conventions and representations

Science as a Human Endeavour

- production of electric power using coal, gas, oil, solar furnace, wind, nuclear, geothermal, tidal, photovoltaics; and advantages and disadvantages of these methods
- lightning as a natural example of charge build-up and discharge
- the protective role of earthing electrical circuits
- efficient use of household electricity
- origin of Earth's magnetic field and its use for navigation

Science Understanding

- static electricity – atoms can gain or lose electrons, so gaining a net charge; and like charges repel and unlike charges attract
- electric current is the rate of flow of electric charge
- the direction of conventional current is that in which the flow of positive charge is considered to take place, while the electron flow is in the opposite direction
- electrical properties of conductors and insulators
- construct simple electrical circuits and measure current and potential difference at various points around the circuit using ammeters, voltmeters and multimeters
- draw and interpret simple circuit diagrams, including the standard symbols for resistor (fixed and variable), light globe, switch, ammeter, voltmeter, cell/battery, and power supply
- energy transformations, such as heating and lighting effects in electrical circuits
- current, voltage and resistance are related as shown in Ohm's law: $V = IR$; as resistance increases, current decreases if voltage remains the same
- factors affecting resistance of a conductor – type of material, length, cross-sectional area
- high resistance conductors can be used to produce heat as in heating elements
- the concepts of electrical current, potential difference and resistance in series and parallel circuits
- the effects of having resistors connected in series
- the effects of having resistors connected in parallel
- power is related to voltage and current. This will include applying the relationship: $P = VI$
- the kilowatt hour is a unit of energy and is used to determine the cost of running electrical appliances
- magnetism and magnetic fields; like poles repel, unlike poles attract
- Earth's magnetic field
- use of compass to plot magnetic fields
- moving charges have magnetic fields
- a current carrying wire in a magnetic field has a force acting on it when it cuts flux lines. This is the principle behind the electric motor
- current is generated in a moving conductor when it cuts magnetic flux lines. This is the principle behind the generator
- the cause of short circuits and electric shock
- identification of hazardous situations and the necessary safety precautions in everyday uses of electrical energy
- the principles behind the operation of various safety devices, such as fuses, RCDs, circuit breakers

School-based assessment

The Western Australian Certificate of Education (WACE) Manual contains essential information on principles, policies and procedures for school-based assessment that needs to be read in conjunction with this syllabus.

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Physics General Year 12 syllabus and the weighting for each assessment type.

Assessment table – Year 12

Type of assessment	Weighting
Science Inquiry **Experiment** Practical tasks are designed to develop or assess a range of laboratory related skills and conceptual understanding of physical principles, and skills associated with representing data; organising and analysing data to identify trends and relationships; recognising error, uncertainty and limitations in data; and selecting, synthesising and using evidence to construct and justify conclusions. Tasks can take the form of practical skills tasks, laboratory reports, and short in-class tests to validate the knowledge gained. **Investigation** Activities in which ideas, predictions or hypotheses are tested and conclusions are drawn in response to a question or problem. Investigations can involve experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations. Assessment tasks can take the form of an experimental design brief, a formal investigation report, or exercises requiring qualitative and/or quantitative analysis of second-hand data. Appropriate strategies should be used to authenticate student achievement on an out-of-class assessment task.	30%
Extended response Tasks can take the form of: individual research assignments involving interpretation of a range of scientific and media texts; case studies; answers to specific questions based on individual research; interpretation and analysis of information in scientific and media texts; oral or multimedia presentations. Appropriate strategies should be used to authenticate student achievement that has been completed as a part of a group or as an out-of-class task.	20%
Test Tasks can involve comprehension and interpretation exercises; analysis and evaluation of qualitative and quantitative information; application of scientific principles to explain situations; use of reasoning to construct scientific arguments and problem solving.	35%
Externally set task A written task or item or set of items of 50 minutes duration developed by the School Curriculum and Standards Authority and administered by the school.	15%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units.

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type
- include the approximate timing of each task (for example, the week the task is conducted, or the issue and submission dates for an extended task).

All assessment types must be included in the assessment outline at least twice with the exception of the externally set task which only occurs once.

The set of assessment tasks must provide a representative sampling of the content for Unit 3 and Unit 4.

Assessment tasks not administered under test/controlled conditions require appropriate validation/authentication processes.

Externally set task

All students enrolled in the Physics General Year 12 course will complete the externally set task developed by the Authority. Schools are required to administer this task in Term 2 at a time prescribed by the Authority.

Externally set task design brief – Year 12

Time	50 minutes
Format	Written
	Conducted under invigilated conditions
	Typically between two and six questions
Content	The Authority informs schools during Term 3 of the previous year of the Unit 3 syllabus content on which the task will be based

Refer to the WACE Manual for further information.

Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units. The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Physics General Year 12 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at www.scsa.wa.edu.au

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the WACE Manual for further information about the use of a ranked list in the process of assigning grades.

Appendix 1 – Grade descriptions Year 12

A	**Understanding and applying concepts** Consistently applies models and principles to describe systems and explain processes in detail. Uses appropriate scientific language, conventions and accurately labelled diagrams. Selects and assesses the relevance of scientific information from provided sources to support a point of view. Organises information and presents logical arguments that are supported by evidence. Performs calculations accurately. Presents detailed working out in a logical manner and uses appropriate conventions.
	Science inquiry skills Formulates a testable hypothesis that states the relationship between dependent and independent variables. Plans and conducts investigations, identifying and controlling appropriate variables and explaining how they will be controlled. Describes the experimental procedure with sufficient detail to allow repetition by others. Consistently organises data logically and presents it in a range of forms, including appropriate tables, graphs and diagrams, and identifies relationships. Processes data and explains trends using relevant scientific concepts. Uses evidence to justify conclusions that relate to the hypothesis. Evaluates the experimental method and provides specific and relevant suggestions to improve the reliability of the data collected. Communicates information and concepts logically, using correct scientific terminology, conventions and representations.

B	**Understanding and applying concepts** Often applies models and principles to describe systems and partially explain processes. Uses scientific language, conventions and labelled diagrams. Selects scientific information from provided sources to support a point of view. Organises information and presents arguments that are not always well supported by evidence. Performs calculations with minor errors. Presents working out in a logical manner and uses appropriate conventions.
	Science inquiry skills Formulates a testable hypothesis that states the relationship between dependent and independent variables. Plans and conducts investigations, identifying and controlling appropriate variables. Describes the steps in the experimental procedure. Presents data in a range of forms, including appropriate tables, graphs and diagrams, and identifies relationships. Describes trends and briefly explains these using relevant scientific concepts. Uses evidence to make conclusions that relate to the hypothesis. Evaluates the experimental method and provides relevant suggestions to improve the reliability of the data collected. Communicates information and concepts logically, generally using scientific terminology, conventions and representations, with minor errors.

C	**Understanding and applying concepts** Describes some systems and processes in a general way. Uses some scientific language, conventions and diagrams that may lack detail. Sometimes selects scientific information from provided sources to support a point of view. Presents general statements supported by some evidence, including some irrelevant or incorrect information. Performs calculations that may be incomplete and contain errors. Presents basic working out with limited use of appropriate conventions.
	Science inquiry skills Formulates a hypothesis, that includes dependent and independent variables, within a provided context. Plans and conducts investigations, identifying and controlling some appropriate variables. Briefly outlines the steps in the experimental procedure. Presents data using basic tables, graphs and diagrams. Describes trends in the data. Draws general conclusions that may not be supported by the data. Provides general suggestions to improve the reliability of the data collected. Communicates information and concepts without detail, using some scientific terminology, conventions and representations, with minor errors.

D	**Understanding and applying concepts** Identifies some systems and processes. Rarely uses scientific language and conventions. Provides simple diagrams with errors or omissions. Makes limited use of evidence to support a point of view. Provides responses that are often incomplete, incorrect or irrelevant. Performs calculations that are incomplete and contain errors.
	Science inquiry skills Makes a simple prediction for an investigation; does not distinguish between dependent, independent and controlled variables. Follows a provided experimental procedure. Follows an experimental procedure. Provides incomplete or incorrect tables, graphs and diagrams. Incorrectly identifies trends in the data, or overlooks trends. Draws conclusions that are not supported by the data. Identifies difficulties experienced in conducting the investigation. Communicates information ineffectively, rarely using scientific terminology, and with frequent errors in the use of conventions and representations.

E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.