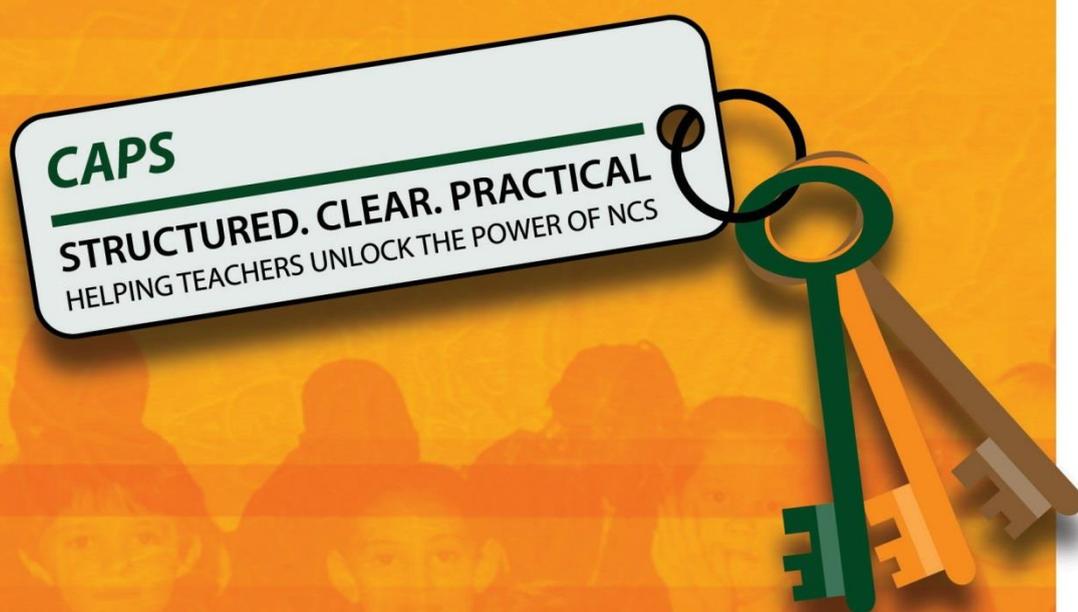


National Curriculum Statement (NCS)

*Curriculum and Assessment
Policy Statement*



*Further Education and Training Phase
Grades 10 – 12*





basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**CURRICULUM AND ASSESSMENT POLICY STATEMENT
GRADES 10 – 12**

NAUTICAL SCIENCE

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SECTION 1**INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENTS FOR NAUTICAL SCIENCE GRADES 10 – 12****1.1 Background**

The *National Curriculum Statement Grades R – 12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector.

To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R – 12.

1.2 Overview

- (a) The *National Curriculum Statement Grades R – 12 (January 2012)* represents a policy statement for learning and teaching in South African schools and comprises the following:
- (i) *Curriculum and Assessment Policy Statements for each approved school subject;*
 - (ii) *The policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12; and*
 - (iii) *The policy document, National Protocol for Assessment Grades R – 12 (January 2012).*
- (b) The *National Curriculum Statement Grades R – 12 (January 2012)* replaces the two current national curricula statements, namely the
- (i) *Revised National Curriculum Statement Grades R – 9, Government Gazette No. 23406 of 31 May 2002, and*
 - (ii) *National Curriculum Statement Grades 10 – 12 Government Gazettes, No. 25545 of 6 October 2003 and No. 27594 of 17 May 2005.*
- (c) The national curriculum statements contemplated in subparagraphs b(i) and (ii) comprise the following policy documents which will be incrementally repealed by the *National Curriculum Statement Grades R – 12 (January 2012)* during the period 2012 – 2014:
- (i) *The Learning Area/Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R – 9 and Grades 10 – 12;*
 - (ii) *The policy document, National Policy on assessment and qualifications for schools in the General Education and Training Band d, promulgated in Government Notice No. 124 in Government Gazette No. 29626 of 12 February 2007;*
 - (iii) *The policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), promulgated in Government Gazette No.27819 of 20 July 2005;*

- (iv) *The policy document, An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding learners with special needs, published in Government Gazette, No.29466 of 11 December 2006, is incorporated in the policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12; and*
- (v) *The policy document, An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R – 12), promulgated in Government Notice No.1267 in Government Gazette No. 29467 of 11 December 2006.*
- (d) The policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12*, and the sections on the Curriculum and Assessment Policy as contemplated in Chapters 2, 3 and 4 of this document constitute the norms and standards of the *National Curriculum Statement Grades R – 12*. It will therefore, in terms of *section 6A of the South African Schools Act, 1996 (Act No. 84 of 1996)*, form the basis for the Minister of Basic Education to determine minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement to be applicable to public and independent schools.

1.3 General aims of the South African Curriculum

- (a) The *National Curriculum Statement Grades R – 12* gives expression to the knowledge, skills and values worth learning in South African schools. This curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives.
- (b) The National Curriculum Statement Grades R – 12 serves the purposes of:
- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
 - providing access to higher education;
 - facilitating the transition of learners from education institutions to the workplace; and
 - providing employers with a sufficient profile of a learner's competences.
- (c) The National Curriculum Statement Grades R – 12 is based on the following principles:
- Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population;
 - Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;
 - High knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects;
 - Progression: content and context of each grade shows progression from simple to complex;

- Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R – 12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors;
 - Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and
 - Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.
- (d) The National Curriculum Statement Grades R – 12 aims to produce learners that are able to:
- identify and solve problems and make decisions using critical and creative thinking;
 - work effectively as individuals and with others as members of a team;
 - organise and manage themselves and their activities responsibly and effectively;
 - collect, analyse, organise and critically evaluate information;
 - communicate effectively using visual, symbolic and/or language skills in various modes;
 - use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
 - demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.
- (e) Inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen if all teachers have a sound understanding of how to recognise and address barriers to learning, and how to plan for diversity.

The key to managing inclusivity is ensuring that barriers are identified and addressed by all the relevant support structures within the school community, including teachers, District-Based Support Teams, Institutional-Level Support Teams, parents and Special Schools as Resource Centres. To address barriers in the classroom, teachers should use various curriculum differentiation strategies such as those included in the Department of Basic Education's *Guidelines for Inclusive Teaching and Learning* (2010).

NAUTICAL SCIENCE GRADES 10 – 12

1.4 Time Allocation

1.4.1 Foundation Phase

(a) The instructional time in the Foundation Phase is as follows:

SUBJECT	GRADE R (HOURS)	GRADES 1 – 2 (HOURS)	GRADE 3 (HOURS)
Home Language	10	8/7	8/7
First Additional Language		2/3	3/4
Mathematics	7	7	7
Life Skills	6	6	7
<ul style="list-style-type: none"> • Beginning Knowledge • Creative Arts • Physical Education • Personal and Social Well-being 	(1) (2) (2) (1)	(1) (2) (2) (1)	(2) (2) (2) (1)
TOTAL	23	23	25

- (b) Instructional time for Grades R, 1 and 2 is 23 hours and for Grade 3 is 25 hours.
- (c) Ten hours are allocated for languages in Grades R – 2 and 11 hours in Grade 3. A maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 2 hours and a maximum of 3 hours for Additional Language in Grades 1 – 2. In Grade 3 a maximum of 8 hours and a minimum of 7 hours are allocated for Home Language and a minimum of 3 hours and a maximum of 4 hours for First Additional Language.
- (d) In Life Skills Beginning Knowledge is allocated 1 hour in Grades R – 2 and 2 hours as indicated by the hours in brackets for Grade 3.

1.4.2 Intermediate Phase

(a) The instructional time in the Intermediate Phase is as follows:

SUBJECT	HOURS
Home Language	6
First Additional Language	5
Mathematics	6
Natural Sciences and Technology	3,5
Social Sciences	3
Life Skills	4
<ul style="list-style-type: none"> • Creative Arts • Physical Education • Personal and Social Well-being 	(1,5) (1) (1,5)
TOTAL	27,5

1.4.3 Senior Phase

(a) The instructional time in the Senior Phase is as follows:

SUBJECT	HOURS
Home Language	5
First Additional Language	4
Mathematics	4,5
Natural Sciences	3
Social Sciences	3
Technology	2
Economic Management Sciences	2
Life Orientation	2
Creative Arts	2
TOTAL	27,5

1.4.4 Grades 10 – 12

(a) The instructional time in Grades 10 – 12 is as follows:

SUBJECT	TIME ALLOCATION PER WEEK (HOURS)
Home Language	4.5
First Additional Language	4.5
Mathematics	4.5
Life Orientation	2
A minimum of any three subjects selected from Group B Annexure B, Tables B1 – B8 of the policy document, <i>National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R – 12</i> , subject to the provisos stipulated in paragraph 28 of the said policy document.	12 (3 x 4h)
total	27,5

The allocated time per week may be utilised only for the minimum required NCS subjects as specified above, and may not be used for any additional subjects added to the list of minimum subjects. Should a learner wish to offer additional subjects, additional time must be allocated for the offering of these subjects.

SECTION 2

2.1 What is Nautical Science?

Nautical Science is the study of the nautical aspects of the maritime environment used in the movement or transport of persons, goods and equipment by sea from one geographical position to another.

The purpose of the subject Nautical Science is to provide an appropriate body of specialised knowledge, skills, attitudes and values that will:

- develop awareness of South Africa as a maritime nation and the importance of the sea to the economy of the country
- prepare the learner for a career at sea at various levels in a marine enterprise
- expose learners to ascending levels of nautical knowledge and ability
- prepare learners for the maritime courses within the higher education sector and for entry into careers in the maritime industry
- stimulate an interest in and enjoyment of maritime activities and
- encourage safe practices in maritime activities.

Nautical Science is both a practical and theoretical orientated subject. It develops competences in the acquisition and use of information required in a seafarer career.

In Nautical Science, learners are introduced to the following four foci covering

- **Nautical navigation**
This section encompasses navigational terminology, principles, concepts and systems as well as the sources of and use of navigational information such as observation, navigational instruments, nautical tables and publications. Opportunities are provided for practical work such as planning and plotting voyages, using mathematical models and formulas to calculate distances, time, courses, tides, depth of water, effects of weather etc.
- **Seamanship**
In this section the focus is on the role of mariner and career opportunities in the nautical industry. It includes nautical terminology, types of vessels and their construction, characteristics, purpose and layout, as well as the factors and forces affecting their handling and their stability. Learners develop skills in ropework and are introduced to types of cordage. They learn about equipment for loading, stowing and discharging cargo and have opportunities to calculate, compare and contrast ways and means of handling cargo. Great emphasis is placed on safety at sea including risks, rules, procedures and equipment. Environmental concerns around shipping are explored.
- **Meteorology**
Learners become acquainted with the physical environment and weather and their impact on the seafarer and the maritime activities, including how to observe and measure the changes to this environment and to assess its influence on maritime activities.
- **Maritime Communications**
This section develops learners' ability to interpret and use communication methods and procedures including signals, codes, flags, flashing lights and distress frequencies

Nautical Science develops learners' ability to logically organise, assess and present the information acquired in a form which is user-friendly. Learners use and apply the acquired information to perform or simulate the performance of the nautical tasks and duties of the seafarer. This includes the procedures and techniques to be followed as well as the use of the hardware/ equipment where practicable.

2.2 Topics to be studied in Nautical Science

Topic 1 Nautical navigation

The focus of this topic is to provide learners with a sound knowledge and understanding of nautical navigation and geographical position and the ability to apply this practically. The knowledge, skills and values gained will provide learners with a sound understanding of nautical charts, navigational implements and equipment and the appropriate navigational publications. They will also provide the learners with the ability to apply principles, techniques and concepts practically in the planning and execution of navigational passages.

Topic 2 Seamanship

This topic is designed to familiarize the learner with the role of the mariner, sea-going vessels, their operation and management. They must demonstrate their understanding of the use of the ship's systems and equipment in order to perform their designed function. Great stress is laid upon safety aspects, international regulations and systems, safety equipment and the procedures to be followed in an emergency.

Topic 3 Meteorology

This topic enables learners to interpret and evaluate meteorological information from a variety of sources available to the seaman in order to assess its affect on shipping and the planning and execution of ocean passages. They will understand the factors that cause the various weather patterns and pressure systems to be found locally and in various other areas of the world and what action to take in the event of violent storms to prevent damage and loss of life.

Topic 4 Maritime Communications

The primary focus of this topic is the use of communications to promote safety at sea. Learners will have a basic knowledge and understanding of the various means employed, how to maximise their employment and ensure effective communications anywhere at sea.

2.3 Career Opportunities

Learners who have completed the requirements of the General Education and Training (GET) Band should have been introduced to certain bodies of knowledge and skills closely related to Nautical Science in Learning Areas such as Social Sciences (Geography), Natural Sciences, and Mathematics. These include knowledge of oceans, rivers and other waterways, environmental issues, ecosystems, basic mathematical skills and an understanding of basic physical science concepts. These will be expanded and become more focused in the Further Education and Training (FET) band.

Learners should keep possible careers in mind when selecting subject combinations. Nautical Science is linked to a number of other Further Education and Training (FET) subjects, namely

- Mathematics
- Physical Science
- Geography
- Maritime Economics

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The nature of the nautical environment as well as the techniques and technology required by the mariner in order to survive and operate in it, requires a firm understanding of the *scientific* principles involved and the practical application of *Mathematics*. Since this course is aimed at the **application** of mathematical and scientific knowledge, such knowledge will have to be acquired outside the Nautical Science course. These two subjects are required if learners continue on to the maritime courses at a tertiary institution.

The tasks of the mariner are performed on the surface of the globe (earth) and involve the movement of vessels from one geographical position to another. Therefore, knowledge and application of certain aspects of *Geography* are beneficial. In addition, given that the major portion of trade between nations is carried by sea, the mariner would benefit from a sound knowledge of *Maritime Economics*.

Whilst the Nautical Science course is aimed at the aspirant mariner and in particular the seaman/deck department there are links to a number of other maritime careers. These include:

Marine Engineering	Naval Architecture	Maritime Law
Oceanography	Marine Biology	Hydrography
Marine Surveying	Fishing	Marine Conservation
Yachting (Leisure/ Recreational)	Marine Salvage	Stevedoring
Ship Chartering	Marine Insurance	

The subject prepares learners for entry-level jobs on ships. Elements of Nautical Science are portable to the NQF level 4 unit standards qualification 'Further Education and Training: Shipping' for learners exiting schools prior to Grade 12 or continuing with their studies via the FET colleges.

Issues to be considered when selecting the subject Nautical Science

Not all learners studying Nautical Science will aspire to a career at sea. For those that do aspire to a career at sea, certain physiological requirements have to be met. For instance:

- the prospective seafarer must have unimpaired vision (i.e. can see without the aid of spectacles or contact lenses);
- he/ she must not be colour blind (i.e. must be able to discern all colours especially red and green);
- he/ she must have unimpaired hearing (i.e. can hear normally, without the assistance of hearing aids);
- he/ she must be medically fit, i.e. must not suffer from physiological disorders that require chronic medication or treatment which could endanger their own or others' safety at sea;
- he/ she cannot have physical/ locomotive disabilities (i.e. the full use of all his or her limbs).

SECTION 3**3.1 Content Outline****Topic 1****Nautical Navigation****Grade 10**

- Use basic navigational terminology to explain navigational principles, concepts and procedures.
- Identify and use sources of data that provide information for navigational processes to calculate and plot positions and lay off courses using bearings.
- Plan a coastal passage between two geographical positions on a nautical chart using data obtained from the observation of terrestrial objects, features and navigational publications.
- Explain the types and use of compasses for the measurement of direction at sea and the reasons and processes for correction.

Grade 11

- Analyse and explain navigational principles and concepts.
- Gather and analyse information using navigational instruments, nautical tables, publications and instrumental observations of the sun.
- Use prescribed mathematical models (sailings) and formulas, and data obtained from nautical tables, to calculate distances, time of passage and courses between geographical positions.
- Explain the principle, construction and use of a sextant as a navigational instrument.

Grade 12

- Analyse and compare navigational systems, their principles of operation, strengths and shortcomings.
- Synthesise information about the altitude and bearings of the sun from a variety of sources including navigational instruments, nautical tables, nautical publications and observation of the sun and plot the position of the vessel on a mercator plotting sheet.
- Apply data obtained through navigational instruments (compass and sextant), from nautical tables and publications and through observation of the sun to fix the position of a vessel anywhere at sea.
- Evaluate the accuracy of the compasses by utilising instrumental observations of the sun and the appropriate nautical tables and publications.

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Topic 2

Seamanship

Grade 10

- Use nautical terminology to describe, illustrate and explain the various types of seagoing vessels utilising South African ports.
- Demonstrate the ability to carry out prescribed rope work and explain the various types of cordage used at sea.
- Describe the basic safety equipment and practices found aboard seagoing vessels and explain the need for safety precautions taken onboard.
- Identify, describe and compare the various roles of deck personnel and perform the duties of a member of the crew of a small sailing vessel.

Grade 11

- Analyse the factors and forces affecting the handling of vessels at sea.
- Explain the use of various types of rigging, cranes and derricks and the calculation of the advantage obtained by various arrangements of blocks and tackles to load, discharge or move objects or cargo handling onboard a ship.
- Consider, evaluate and recommend the factors to be considered and rules and procedures to be followed in the event of various types of emergency situation arising at sea.
- Investigate, categorise and compare Nautical Science related careers including the background training required and the types of work activity involved.

Grade 12

- Evaluate the factors and forces affecting the stability of ships including the hull stresses, loadlines and zones and the effect of the loading, stowing and moving of cargo or ballast.
- Compare and contrast the methods of loading, stowage and discharging cargo on and from various types of commercial vessel.
- Analyse and evaluate the safety procedures needed to ensure safety on board.
- Investigate the development of a human rights approach to sea-going employment to avoid exploitation.
- Investigate the effect of pollution caused by ships on the environment and recommend possible preventative measures.

Topic 3

Meteorology

Grade 10

- Explain the various sources of meteorological data used by the mariner.
- Describe the various meteorological instruments carried onboard a sea-going vessel and explain what they measure.
- Explain the various elements and processes in the formation of weather, how they interact with each other and how they affect the sea conditions.
- Describe meteorological factors that impact on shipping in port and at sea.

Grade 11

- Conduct synoptic chart reading of weather patterns to predict the effect of weather systems on the planning of ocean voyages.
- Distinguish between the different isobaric systems found at sea and explain their influence on navigation.
- Evaluate the influence of sea currents on weather patterns and the impact on navigation off the South African coast.

Grade 12

- Access and apply information of various weather phenomena to determine their effect on planned passages.
- Explain the system of weather reporting used at sea.
- Categorise the weather patterns found in various parts of the globe and their impact on shipping.
- Predict the action to be taken by ships when faced with adverse weather conditions.

Topic 4

Maritime Communications

Grade 10

- Identify what procedures should be followed as well as signals and codes used for communicating at sea.
- Identify and compare the strengths and weaknesses of the various methods of communication at sea.
- Interpret the single meanings of prescribed signal flags used for communicating at sea.

Grade 11

- Identify good operator practices used for effective and efficient communications at sea using a manual system.
- Demonstrate the use of distress frequencies, the significance of distress periods and the procedures used for distress communications at sea.
- Pass messages utilising the phonetic alphabet and explain its purpose and value.

Grade 12

- Analyse and evaluate effective communication practices using an automated system to ensure safety on board a vessel.
- Analyse and explain the concept, organisation and operation of the Global Maritime Distress and Safety System used at sea.
- Draft emergency messages, ready for transmission and explain the procedure for their use.

TOPICS AND CONTENT

In this section content and contexts are provided to support the attainment of the Assessment Standards. The content indicated needs to be dealt with in a way that will assist the learner to progress towards the achievement of the Topics. Content must serve the Topics and not to be an end in itself. The contexts suggested will enable the content to be embedded in situations which are meaningful to learners and so assist learning and teaching. The teacher should be aware of and use local contexts, not necessarily indicated here, which could be more suited to experiences of learners.

Topic 1 Nautical Navigation

Grade 10

Content

Use basic navigational terminology to explain navigational principles, concepts and procedures. What navigation entails and its importance to the safety of the ship:

- what is navigation – defining nautical navigation and its importance in shipping operations
- navigation terminology definitions:
 - latitude
 - longitude
 - differences in latitude & longitude
 - great & small circles
 - departure
 - nautical mile
 - true course & bearings
- purpose of navigation and the importance of safety
- the role & responsibilities of the navigator as a member of the ship's management team and his responsibilities including the need for diligent and responsible watch keeping.
- tools of the navigator, their physical location and how they are used:

Instruments	Publications	Equipment
Chronometers Compasses and compass repeaters Azimuth circles Sextants Parallel rulers Dividers and compasses Soft lead pencils	Navigation publications List of lights and radio signals Sailing directions Mariner's handbook Tide tables Nautical almanac Notices to mariners Nautical tables (Nories) Chart symbols & abbreviations Charts and logbooks	Radio Direction Finder Echo sounder/ depth recorder Radar GPS Ship's log/ distance recorder Compasses

- geographical position – measurements of position, distance and speed
 - measurement of geographical position and distance on the earth's surface including prime meridian, meridians, equator, great circles, longitude, D.long, Latitude, D.lat, departure
 - measurement of distance on a navigation chart including sea mile, nautical mile, geographical mile, use of latitude scale
 - speed at sea including unit of speed – knot, relationship between speed, time and distance
 - measurement of direction
- symbols and abbreviations

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Number and title	Scale	Notes and notices.
Chart datums (heights & depths)	Corrections	Compass rose
Buoys	Lights	Beacons
Racons	Navigational aids	Traffic separation schemes
Nature of bottom	Contours	Tides & tidal streams
Areas of regulation/ restriction	Coastal recognition	Underwater obstructions/ wrecks
Land-based features (lighthouses, radio masts)		Leading marks/ lights

- plotting conventions

Identify and use sources of data that provide information for navigational processes to calculate and plot positions and lay off courses using bearings.

- Observation of terrestrial objects, features and navigational publications.
- Nautical charts used for navigation – types of chart used for navigation and their characteristics (e.g. mercator, gnomonic)
- Implements and equipment used by the navigator

Plan a coastal passage between two geographical positions on a nautical chart using data obtained from the observation of terrestrial objects, features and navigational publications.

- Plan a simple coastal passage between two positions, using charts, correct charts, instruments and publications, interpretation of data, practical plotting, presentation and motivation of proposed plan.
- Basic chart work including
 - the concept of position lines and circles and be able to plot them on a chart including sources of data and symbols
 - the concept of fixes and be able to plot the various types on a chart e.g. definition, types and sources, visual, radio direction finding (including application of convergency), radar ranges & bearings, range from vertical sextant angle and horizontal sextant angle, angles, transits (including determination of compass error, GPS, observed position (celestial sights), dead reckoning, running fixes, observed position (terrestrial)
 - the use of lights and lighthouses for navigation purposes including lighthouse characteristics, ranges of lights (nominal, geographical, luminous), rising and dipping ranges for determining a position circle and leading lights and markers.

Explain the types and use of compasses for the measurement of direction at sea and the reasons and processes for correction.

- Types: gyro compass, azimuth circle, repeaters, magnetic compass
- Angles, courses and the various types of bearings: relative, three figure notation, cardinal & intercardinal points, true north, magnetic north
- Causes of compass error, be able to determine their magnitude and be able to apply them: Gyro error, variation, deviation
- Reasons for correction: lines of magnetism, effects of steel, magnetic signatures, magnetic currents

Grade 11**Content**

Analyse and explain navigational principles and concepts.

Differences in time at sea and be able to convert from one category of time to another

- Time at sea – local mean time (LMT)
- Greenwich mean time/ universal time (GMT/ UT)
- Zone time
- Standard time
- Ship's time
- Nautical almanac – celestial sphere e.g. celestial bodies, polar distance, geographical position, observer's zenith, celestial/ rational horizon, observer's meridian, plane of the celestial horizon, vertical circles, prime vertical, principal vertical, azimuth of a heavenly body, altitude, true altitude, zenith distance, true altitude of the pole, observer's sea or visible horizon
- Celestial navigation (sunrise, sunset, civil and nautical twilight, meridian passage of the sun). Concept of the celestial sphere and how it is used for navigational purposes including celestial bodies, apparent motion of the celestial sphere, angular distance between stars, celestial meridians, position of celestial bodies in the celestial sphere, declination, hour angle, Greenwich hour angle, local hour angle

Gather and analyse information using navigational instruments, nautical tables, publications and instrumental observations of the sun.

- Determining latitude by observation of the meridian passage of the sun
- Plot coastal passages on a chart taking into account all factors and forces that may influence them
- Calculate the depth of water anywhere at any time along the South African coast
- Predict the state, times and heights of tide at any south African port
- Understand the forces causing tides and the various levels of tide which result.
- Utilise the tide tables to determine the heights and times of high and low water and together with the use of a graph predict the times and heights of the tide at any South African port.
- Be familiar with the following terms
 - Spring tides
 - Neap tides
 - Highest astronomical tide (HAT)
 - Lowest astronomical tide (LAT)
 - Mean high water springs (MHWS)
 - Mean low water springs (MLWS)
 - Mean high water neaps (MHWN)
 - Mean low water neaps (MLWN)
 - Mean sea level
 - Chart datum
 - Tide tables
- Understand the cause and nature of currents, tidal streams and leeway, be able to determine the direction and magnitude of currents, tidal streams and leeway and be able to make allowance for them when determining courses to steer e.g.
 - Set, rate and drift of a current
 - Leeway
 - Estimated position allowing for current
 - Estimated position allowing for current and leeway
 - Course to steer to counter the current
 - Course to steer to counter current and leeway

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Use prescribed mathematical models (sailings) and formulas, and data obtained from nautical tables, to calculate distances, time of passage and courses between geographical positions
Use the traverse tables and nautical publications to solve 'Sailing' problems e.g.

- Determining course and distance between two geographical positions situated on the same latitude using the parallel sailing method.
- Determining course and distance between two geographical positions not situated on the same latitude and the distance is relatively small using the plane sailing method.
- Determining the course and distance between two geographical positions which are in different latitudes with large d.lats and distances using the mercator sailing method.

Explain the principle, construction and use of a sextant as a navigational instrument.

- Identify the various parts of the sextant, explain its operation in astro-navigation observations and be able to apply the necessary corrections to the instrument.
- Identify the origin of the errors affecting the observed altitude of the sun and be able to apply the necessary corrections to obtain a usable altitude (e.g. index error, dip, refraction, semi-diameter, parallax, total correction)
- Take a sun sight with the aid of a sextant.

Grade 12

Content

Analyse and compare navigation systems, their principles of operation, strengths and shortcomings.

- The development of electronic navigation systems and use of the GPS system to determine geographical position
 - Marine radio beacons
 - Radar transponder beacons
 - Decca hyperbolic position fixing system,
 - Satellite navigation (SATNAV) system
 - Global Positioning system
 - Radar - the use of radar for navigational purposes and collision avoidance, use relative velocity mathematical models to determine the parameters of movement of other vessels in the vicinity of a given vessel
- Celestial navigation

Synthesise information about the altitude and bearings of the sun from a variety of sources including navigational instruments, nautical tables, nautical publications and observation of the sun and plot the position of the vessel on a mercator plotting sheet.

- The spherical triangle
- The Marq St Hilaire method of sight reduction

Apply data obtained through navigational instruments (compass and sextant), from nautical tables and publications and the observation of the sun to fix the position of a vessel anywhere at sea.

- Astro-navigation – calculate and plot an observed position line, using the Marq St Hilaire method of sight reduction and a sextet altitude of the sun
- Fix the ship using a sun sight and a latitude obtained from a meridian passage of the sun

AS 12.1.4 Evaluate the accuracy of the compasses by utilising instrumental observations of the sun and the appropriate nautical tables and publications.

- Azimuth and amplitude methods

Topic 2 Seamanship**Grade 10****Content**

Use nautical terminology to describe, illustrate and explain the various types of seagoing vessels utilising South African ports.

- Concept, characteristics and design features of various types of ships
 - Passenger ships – decline as main means of passenger transport
 - General cargo ships
 - Container vessels – advantages of container ships, disadvantages
 - Ro-Ro vessels
 - Bulk carriers
 - Oil tankers
 - Combination carriers
 - Liquefied gas carriers
 - Reefer
- General layout of vessels and the nautical terms for parts e.g. Hull, surfaces and fittings, terms applied to hull, decks, superstructure, miscellaneous fittings
- General construction of vessels, the materials used (with their various strong & weak points and the nautical terms for the various parts (steel, aluminium, wood, GRP, hull plating,
- Strakes, frames, keel, stem & stern posts, longitudinals, beams and girders, decks & bulkheads, double bottoms
- Purpose, procedures and activities on ships

Demonstrate the ability to carry out prescribed rope work and explain the various types of cordage used at sea.

- Rope-work including bends, hitches, splices, whippings, and basic rigging.
- Rope and its usage – types of rope and what each is used for (hemp, manila, sisal, cotton, polypropylene, polyethylene, polyester, polyamide)
- Bends and hitches – how to tie certain prescribed knots and know what they are used for (bowline, bowline on the bight, reef knot, sheet bend, double sheet bend, round turn and two half hitches, figure of eight, carrick bend, clove hitch, timber hitch, rolling hitch, constrictor knot, double thumb knot)
- Splices – three types of splices and know where they are used – eye splice, back splice, short splice
- Whippings – know how to do a common whipping
- Rigging – know how to rig a bosun's chair and a rigging stage

Describe the basic safety equipment and practices found aboard seagoing vessels and explain the need for safety precautions taken onboard.

- Basic emergency procedures in the event of a person falling overboard or a fire being discovered onboard.
- Basic causes of fires at sea, the various types of fire and the elements of fire, methods of fighting them, and fire appliances.
- Role of the watch-keeper – bridge lookouts, helmsman, importance of alertness and accountability
- Steering – the typical helm orders a helmsman might be given, what the appropriate responses are and the importance of efficient steering.
- Typical accidents which may occur at sea, their causes and preventative measures which can be taken

NAUTICAL SCIENCE GRADES 10 – 12

Identify, describe and compare the various roles of deck personnel and perform the duties of a member of the crew of a small sailing vessel.

- Roles and responsibilities of officers, bosun and seamen
- Sailing terms, the parts of a sailing boat/ dinghy – hull and fittings, spars and standing rigging, running rigging, sails and basic rules of the road for sailing
- How to act as crew on a sailing dinghy
- How to rig and prepare a sailing dinghy for sailing – raising the mast, rigging the jib, rigging the mainsail, conduct boat checks before launching, launch a sailing dinghy and bring it back on shore,
- How to recover a crew member who has fallen overboard
- How to right a capsized dinghy

Grade 11

Content

Analyse the factors and forces affecting the handling of vessels at sea.

- Stopping a vessel – factors affecting acceleration and decelerate as well as the various methods used to stop a vessel, methods of stopping a vessel, anchoring with two anchors.
- Handling a vessel in heavy weather
- Search and rescue – search patterns, rescue plans, recovery of persons falling overboard, boat work in heavy weather, ship disabled or in distress, rescuing the crew of a disabled ship, distress signals – various types, quantities and specifications of distress signal, flares to be carried by vessels and lifeboats, abandoning ship.
- Groundings and collisions – consequences, considerations and actions to be taken
- Control of fire at sea – threat posed, prevention and procedures to combat fires
- Towing procedures – principles and processes for towing another vessel
- Watch keeping procedures

Explain the use of various types of rigging, cranes and derricks and the calculation of the advantage obtained by various arrangements of blocks and tackles to load, discharge or move objects or cargo handling onboard a ship.

- Working with cargoes
- Use of blocks and tackles and calculations

Consider, evaluate and recommend the factors to be considered and rules and procedures to be followed in the event of various types of emergency situation arising at sea.

- Search and rescue procedures
- Groundings and collisions
- Control of fire at sea
- Towing operations
- International Association of Lighthouse Authorities (IALA) system of buoyage: identify the various buoys and their purpose – description of system, lateral marks, cardinal marks, isolated danger marks, safe water marks, special marks, new dangers.
- Rules contained in the international regulations for the prevention of collisions at sea
 - International Regulations for Preventing – definitions, application, responsibility
 - Conduct of vessels in any condition of visibility – application, lookout, safe speed, risk of collision, action to avoid collision, narrow channels, and traffic separation schemes
 - Conduct of vessels in sight of one another – application, sailing vessels, application, sailing vessels, overtaking, head-on situation, crossing situation, action by giving-way vessel, action by stand-on vessel, responsibilities between vessels

- Conduct of vessels in restricted visibility
- Lights and shapes – application, definitions, visibility of lights, power-driven vessels underway, towing and pushing, sailing vessels underway and vessels under oars, fishing vessels, vessels not under command and vessels restricted in their ability to manoeuvre, vessels constrained by their draft, pilot vessels, anchored vessels and vessels aground, seaplanes
- Sound and light signals – definitions, equipment for sound signals, manoeuvring and warning signals, sound signals in restricted visibility, signals to attract attention.

Investigate, categorise and compare Nautical Science related careers including the background training required and the types of work activity involved.

- Seaman, navigating officer, marine engineering, naval architecture, maritime law, oceanography, marine biology, hydrography, marine surveying, fishing, marine conservation, yachting (leisure/ recreational), marine salvage, stevedoring, ship chartering, marine insurance.

Grade 12

Content

Evaluate the factors and forces affecting the stability of ships including the hull stresses, loadlines and zones and the effect of handling and stowing of cargo or ballast.

- Terminology, concept and definitions – tonnage deck, tonnage, gross tonnage, net or register tonnage, deadweight tonnage, Archimedes' law, displacement, buoyant volume, buoyancy, reserve of buoyancy, centre of gravity, centre of buoyancy, righting lever, metacentre, heel, list, trim, loll
- States of equilibrium – stable equilibrium, neutral buoyancy, unstable equilibrium
- Trim
- Effect of the movement of cargo/ ballast/ personnel
- Hull stresses – stresses to which the hull of a ship is subjected both afloat and in dry-dock, e.g. longitudinal stresses, transverse stresses, local stresses
- Loadlines and loadline zones
- Global zoning/ seasonal zones/ areas

Compare and contrast the methods of loading, stowage and discharging cargo on and from various types of commercial vessel.

- Passengers
- Bulk cargo
- Breakbulk cargo including palletized and heavylift cargo
- Containers
- Liquid cargo including liquefied gas
- Ro-ro cargo

Analyse and evaluate the safety procedures needed to ensure safety on board.

- The documentation a vessel is obliged to carry (logbooks and certification)
- International regulations on the safe loading, carrying and discharging of cargo.

NAUTICAL SCIENCE GRADES 10 – 12

Investigate the development of a human rights approach to sea-going employment to avoid exploitation.

Seafaring employment issues such as:

- STCW 95 Convention
- Contract seafaring
- The major sources of the world's seafarers (e.g. Philippines, China, Eastern Europe)
- Reasons for the decline in previously major seafaring nations
- Incentives for countries to promote seafaring (e.g. tonnage tax, cabotage, training incentives)
- Case studies of the exploitation of seafarers

Investigate the effect of pollution caused by ships on the environment and recommend possible preventative measures.

- Pollution caused by sea-going vessels – oil, waste disposal, ballast water and the carriage of dangerous cargoes
- Measures to prevent pollution

Topic 3: Meteorology

Grade 10

Content

Explain the various sources of meteorological data used by the mariner.

- Sources of weather information available to the mariner, with particular emphasis placed on the environment off the SA coast.

Describe the various meteorological instruments carried onboard a sea-going vessel and explain what they measure.

- Thermometer – temperature
- Barometer – atmospheric pressure
- Hygrometer – humidity
- Barograph – atmospheric pressure over time
- Anemometer – wind speed and direction

Explain the various elements and processes in the formation of weather, how they interact with each other and how they affect the sea conditions.

- The source and process by which the earth and the atmosphere is heated (e.g. insolation, heating of the atmosphere, radiation, conduction, convection, turbulence)
- The role played by humidity in the formation of our weather as well as the formation of clouds, fog, wind, atmospheric pressure, depressions, currents.
- The role played by wind in the formation of our weather, how it is caused (e.g. geostrophic/coriolus force, beaufort wind scale) and how it is depicted on weather maps.
- The role played by atmospheric pressure in the formation of depressions and anti-cyclones and how pressure systems are displayed on weather maps
- A front is and how it is formed (warm fronts, cold fronts)
- Sea state and abnormal waves

Describe meteorological factors that impact on shipping in port and at sea.

- Wind
- Precipitation
- Storms

Grade 11

Content

Conduct synoptic chart reading of weather patterns to predict the effect of weather systems on the planning of ocean voyages.

- Recognition of various features on synoptic charts

Distinguish between the different isobaric systems found at sea and explain their influence on navigation.

- Variations of depressions and anti-cyclones as well as the formation of fronts and frontal depressions
 - High pressure ridges
 - Low pressure troughs
 - Cols
 - Air masses and fronts
 - Frontal depressions

Evaluate the influence of sea currents on weather patterns and the impact on navigation off the South African coast.

- Origins of the currents found on the South African coast and their effect on the weather off the respective coasts – Benguela current, Mozambique/ Agulhas current

Grade 12

Content

Access and apply information of various weather phenomena to determine their effect on planned passages.

- Origin and nature of tropical storms as well as the procedures for avoiding them – warning signs, track of the storm (southern hemisphere), finding the path of the storm, rules for avoiding tropical storms (southern hemisphere)

Explain the system of weather reporting used at sea.

- The use of global weather maps
- The use of routing charts
- Weather codes
- Reporting forms
- Data recording books

NAUTICAL SCIENCE GRADES 10 – 12

Categorise the weather patterns found in various parts of the globe and their impact on shipping.

- Monsoons – causes of the monsoons and the weather associated with them:
- Frontal systems
- Tropical cyclones
- Depressions

Predict the action to be taken by ships when faced with adverse weather conditions.

- Depressions and frontal systems
- Tropical cyclones
- Fog

Topic 4: Maritime Communications

Grade 10

Content

Identify what procedures should be followed as well as signals and codes used for communicating at sea.

- How vessels identify one another at sea
- Components of a single message (call, identity, text, ending)
- Flashing light procedures
- Radio communication procedures
- Flags
- Codes e.g. Morse code, international code of signals (interco)

Identify and compare the strengths and weaknesses of the various methods of communication at sea.

- Flags
- Flashing light
- Radio
- Sound
- Pyrotechnics

Interpret the single meanings of prescribed signal flags used for communicating at sea.

- Alphabetical flags A-Z, numeral pennants 1-0, substitutes 1-3, answering pennant

Grade 11

Content

Identify good operator practices used for effective and efficient communications at sea using a manual system.

Demonstrate the use of distress frequencies, the significance of distress periods and the procedures used for distress communications at sea.

- Distress & safety communications at sea – need for different distress frequencies, the significance of distress periods and the procedures used for distress communications – distress frequencies, silence periods, distress messages (MAYDAY), urgency communications (PAN-PAN), safety communications (SECURITE)
- Radio procedure – correct procedures to use when operating radio.

Pass messages utilising the phonetic alphabet and explain its purpose and value.

Using:

- basic radio operating procedures
- a flashing light.

Grade 12

Content

Analyse and evaluate the effective communication practices using an automated system to ensure safety on board a vessel.

- Concept of automated communication systems
- Principles of good use

Analyse and explain the concept, organisation and operation of the Global Maritime Distress and Safety System used at sea.

- Purpose
- Areas of operation
- Composition
- Requirements
- Personnel requirements
- Equipment requirements
- Non GMDSS vessels
- Radio communication services
- Maritime mobile service identity numbers (mmsi)

Draft emergency messages ready for transmission and explain the procedure for their use.

- distress messages (MAYDAY),
- urgency communications (PAN-PAN)
- safety communications (SECURITE)

SECTION 4**ANNUAL ASSESSMENT REQUIREMENTS****4.1 Introduction**

Assessment in Nautical Science in Grades 10 – 12 forms an integral part of the teaching and learning process. The purpose of assessment is to monitor progress and provide feedback, diagnose barriers to learning, guide the selection of learning materials, guide and support learning and provide evidence to support the promotion of learners to the next grade. It helps learners to measure their progress and take control of their learning. It helps teachers to find out how teaching and learning activities and processes are contributing to progress towards the achievement of the Nautical Science Topics.

In Nautical Science, the process of identifying, gathering and interpreting information about learner achievement consists of practical work, written tasks, tests, examinations, research and any other tasks relating to Nautical Science. The evidence for internal assessment is collected in the file. Teachers should use a variety of assessment activities, methods, tools and forms to assess the practical and theoretical aspects of Nautical Science.

The teacher must establish the purpose of each assessment task so that assessment is transparent and open. For assessment to be fair and appropriate, the assessment activity must match the method of assessment and the assessment must cover work with which learners have engaged. A particular method and instrument should give learners ample opportunities to demonstrate the attainment of one or more of the Topics. This will only be possible if the chosen activities and instruments are appropriate for the target group and Topics being assessed.

Suggested weighting of Topics in Nautical Science:

Navigation is the most important aspect of nautical Science and has the largest amount of content. The concepts and skills are the most difficult to master and hence requires the greatest amount of time to teach. Seamanship is the next most important aspect and has considerable content. The concepts and skills are easier to master and take less time to teach. Meteorology and communication are equally important but slightly less so than navigation and seamanship. The content for both is considerably less than navigation and seamanship. The concepts and skills involved with meteorology are more difficult to master than communication and takes slightly longer to teach.

TOPICS	GRADES 10 – 12
LO1: Navigation	50%
LO2: Seamanship	30%
LO3: Meteorology	10%
LO4: Communications	10%
TOTAL	100%

4.2 Daily assessment Grades 10, 11 and 12

In Nautical Science daily assessment is the informal monitoring of learners' progress. This is done through observation, discussions, learner-teacher conferences, informal classroom interactions and homework. The activities provide learners with opportunities to develop the skills, knowledge and values required to complete the tasks in the Programme of Assessment. These assessment activities should be reflected in the teachers' Work Schedule and lesson planning and should not be seen as separate from the learning activities taking place in the classroom. Informal daily assessment does not have to be recorded and is not taken into account for promotion or certification purposes, but the Nautical Science teacher could keep notes on the development of learners' knowledge, skills and values, learners' strengths and weaknesses and additional support required and provided during these activities.

In addition to tests and examinations, assessment activities may include opportunities for:

- source-based activities – finding, selecting, reading, comprehending, analysing, interpreting, using and applying information from a wide range of sources
- map reading, labelling of maps
- reading charts, plotting charts
- planning voyages
- formulaic calculations
- analysing graphics, tables and other forms of data
- discussions
- debates
- research
- interviews
- composing letters and articles on topical issues
- presentations
- excursions (including visits to work places)
- drawings, sketching and design tasks
- designing maritime related games
- model-building of ships and harbours
- simulations
- scenario planning
- case studies and
- role-play.

Tools that may be used to assess the tasks include:

- Rubrics
- Checklists
- Memoranda
- Observation sheets

4.3 Programme of assessment in Grades 10 and 11

The Programme of Assessment for Nautical Science in Grades 10 and 11 comprises seven (7) tasks, which are internally assessed. The five tasks, which are completed during the school year, make up 25% of the total mark of Nautical Science. The end-of-year examination makes up the remaining 75%

NAUTICAL SCIENCE GRADES 10 – 12

PROGRAMME OF ASSESSMENT (400 marks)	
ASSESSMENT TASKS	END-OF-YEAR ASSESSMENT
25% (100 marks)	75% (300 marks)
<ul style="list-style-type: none"> • 2 tests • 1 exam (mid year) • 3 other tasks 	<ul style="list-style-type: none"> • 2 written exams Topic 1 – 4 • Paper 1 – 150 marks • Paper 2 - 150 marks

Example of a Programme of Assessment for Grades 10:

TERM 1	TERM 2	TERM 3	TERM 4
Task 1: Test Topic 1 Navigation 50 marks	Task 3: Research Task Planning a voyage 50 marks	Task 5: Test Topic 1,3,4 100 marks	Task 7: Exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2,3,4 150 marks
Task 2: Practical Assignment: Practical sailing 50 marks	Task 4: Midyear exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2 150 marks	Task 6: Practical Assignment Topic 3, Topic 4 Meteorology/Communication 50 marks	
100 marks	350 marks	150 marks	300 marks
600 marks divided by 6 = 100 marks			

Example of a Programme of Assessment for Grades 11:

TERM 1	TERM 2	TERM 3	TERM 4
Task 1: Test Topic 1 Navigation 50 marks	Task 3: Research Task Tidal phenomena 50 marks	Task 5: Test Topic 2 – 4 100 marks	Task 7: Exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2,3,4 150 marks
Task 2: Practical Assignment: Safety at sea 50 marks	Task 4: Midyear exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2,3,4 150	Task 6: Practical Assignment Topic 3, Topic 4 Meteorology and/or Communication 50 marks	
100 marks	350 marks	150 marks	300 marks
600 marks divided by 6 = 100 marks			

Tasks

In addition to two tests and two examinations in Grade 10 and 11 Programmes of Assessment, Nautical Science learners should also be assessed in three other tasks such as a practical sailing a small boat assignment, a meteorology and communication assignment and a research task. See Appendix A for ideas of research tasks and assignments.)

Tests

The suggested outline for tests is as follows:

- Minimum of 50 marks
- Duration: 1 hour
- Questions at different cognitive levels

NAUTICAL SCIENCE GRADES 10 – 12

Each task and examination must cater for a range of cognitive levels and abilities of learners. The following is used as a guide to compile tasks and examination questions encompassing the different cognitive levels: See Appendix B for Bloom’s Taxonomy of Cognitive Levels

COGNITIVE LEVEL	PERCENTAGE	MARKS
Knowledge	30	90
Comprehension	20	60
Application	30	90
Analysis, evaluation and synthesis	20	60
	100 percentage	300 marks

Examinations in Grades 10 and 11

The midyear and end-of-year examination papers should test the knowledge and skills covered in the four Nautical Science Topics. The preparatory examinations need to be closely related to the final examination in terms of time allocation, layout of paper and mark allocations.

The examination mark, which is the raw score in June and September must be used for the calculation of the internal assessment mark for promotion purposes.

The following table suggests the outline for examinations in Grades 10 and 11

	MARKS Grade 10	
	PAPER 1	PAPER 2
Time	3 hours	3 hours
Marks	150 marks	150 marks
Topics	Topic 1	Topic 2,3,4
Questions (All questions compulsory)	Practical chartwork and navigation calculations	Seamanship, meteorology and communications
TOTAL	150 marks	150 marks

	MARKS Grade 11	
	PAPER 1	PAPER 2
Time	3 hours	3 hours
Marks	150 marks	150 marks
Topics	Topic 1	Topic 1,2,3,4:
Questions (All questions compulsory)	Practical chartwork and astro-navigation	Seamanship, meteorology, communications and sailings
TOTAL	150 marks	150 marks

4.4 Assessment in Grade 12

In Grade 12, assessment consists of two components: a Programme of Assessment which makes up 25% of the totals mark for Nautical Science and external assessment which makes up the remaining 75%. The Programme of Assessment for Nautical Science comprises six (6) tasks, which are internally assessed. The external assessment component includes two written papers making up the remaining 75%. The external assessment tasks are externally set and moderated.

NAUTICAL SCIENCE GRADES 10 – 12

GRADE 12 PROGRAMME OF ASSESSMENT (400 marks)	
ASSESSMENT TASKS	END –OF-YEAR ASSESSMENT
25% (100 marks)	EXAM PAPER 75% (300 marks)
<ul style="list-style-type: none"> • 2 tests • 2 exams (mid year and preliminary exam) • 2 other tasks 	<ul style="list-style-type: none"> • Two Written examinations Topic 1 – 4

Grade 12

TERM 1	TERM 2	TERM 3	TERM 4
Task 1: Test Topic 1 Navigation 50 marks	Task 3: Research Task Environmental Challenges 50 marks	Task 5: Test Topic 2 – 4 50 marks	Task 7: Exam Paper 1 Topic 1 Practical Navigation 150 marks
Task 2: Practical Assignment: Astro navigation problem 50 marks	Task 4: Midyear exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2,3,4 150 marks	Task 6: Preliminary examination Exam Paper 1 Topic 1 Practical Navigation 150 marks Paper 2 Theory Topic 2,3,4 150 marks	Paper 2 Theory Topic 2,3,4 150 marks
100 marks	350 marks	350 marks	300 marks
800 marks divided by 8 = 100 marks			

4.4.1 Programme of Assessment for Grade 12

The Programme of Assessment for Nautical Science in Grade 12 comprises 6 tasks, which are internally assessed. Of the six tasks, two are examinations and two are tests.

Tasks

The remaining two tasks consist of different forms such as an assignment or a research task.

The teacher can decide what type of assignments to use from the following list:

Practical exercises, demonstrations, visual sessions, site excursions, presentations, interviews or case studies. See Appendix A for examples of research projects and assignments.

Tests

The suggested outline for tests is as follows:

- Minimum of 50 marks
- Duration: 1 hour
- Questions at different cognitive levels

NAUTICAL SCIENCE GRADES 10 – 12

Each test and examination must cater for a range of cognitive levels and abilities of learners. See Appendix B for Bloom’s Taxonomy of cognitive levels

The following is used as a guide to compile tasks and examination questions encompassing the different cognitive levels:

COGNITIVE LEVEL	PERCENTAGE	MARKS
Knowledge	30	90
Comprehension	20	60
Application	30	90
Analysis, evaluation and synthesis	20	60
TOTAL	100	300

4.4.2 Examinations in Grades 12

In Grade 12 the two three-hour mid year and preliminary examination papers should test the knowledge and skills covered in the four Nautical Science Topics. The preparatory examinations need to be closely related to the final examination in terms of time allocation, layout of paper and mark allocations. The final examination may examine learners on material from Grade 10, 11 and 12. At least 30% of the examination paper should be drawn from the Grade 10 and 11 curriculum.

The examination mark, which is the raw score in June and September must be used for the calculation of the internal assessment mark for promotion purposes.

The following table suggests the outline for examinations in Grades 12.

	MARKS	
	PAPER 1	PAPER 2
Time	3 hours	3 hours
Marks	150 marks	150 marks
Topics	Topic 1	Topic 1,2,3,4
Questions (All questions compulsory)	Practical navigation and astro-navigation	Seamanship, meteorology and communication and sailings
TOTAL	150 marks	150 marks

4.5 Promotion

For promotion and certification purposes learners should achieve at least a level 2 rating (elementary achievement: 30 – 39%) in Nautical Science. This is subject to the requirement that a learner must achieve at least a level 3 rating (Moderate Achievement: 40 – 49%) in at least one of the three choice subjects.

4.6 Moderation of assessment

Moderation ensures the validity of assessment instruments, the fairness of the assessment processes and the reliability of assessment decisions by all assessors according to agreed standards. Moderation standards must be transparent and thus set before teaching, learning and assessment begins.

All Grade 10 and 11 tasks are internally moderated within the school, while all Grade 12 tasks need to be internally and externally moderated. The subject head for Nautical Science or any other head of Department at the school will generally manage the process. The assessment of this task will be carried out using an assessment rubric.

4.6.1 Internal Moderation

As part of its school assessment policy, each school should have an internal moderation policy. Internal moderation must ensure that school-based assessment is consistent, accurate and well designed. Transparency in the methods used is of the utmost importance. Moderation methods will include face moderation, moderation of practical activities, moderation of products, script or file moderation. Performance assessment work must be face moderated. Care must be taken in group work that the distribution of marks / rating codes can be correlated with that of the written work for the group.

4.6.2 External Moderation

As part of the national assessment policy, each province should have an external moderation policy. External moderation must ensure that school-based assessment is consistent, accurate and well designed. Criteria must be drawn up by the relevant moderators, prior to the commencement of moderation. Transparency in the methods used is of the utmost importance. Files of those learners whose progression is questioned during the year, should be made available to the Curriculum Advisor/ District Officers.

4.6.3 Files

Two types of files are required:

The teacher's file contains the Learning Programme (Subject Framework, Work Schedule and Lesson Plans), all the instructions and assessment criteria, marking memoranda and rubrics pertaining to all the internal assessment tasks set for the learners as well as attendance registers, and interventions.

The learner's file may be described as a purposeful, accumulated body of work produced by the learner, providing evidence of learning and growth, which supports an teacher's assessment of the learner's progress towards or attainment of the required topics. The learner file contains the evidence of the formal assessments that are used to calculate the learner's internal assessment mark e.g. research tasks, tests, examinations, assignments and projects. Informal assessment activities may be kept in the file but should be separated from the formal assessment, which should be easy to locate in the file for moderation purposes.

Learners' files should be located in the most appropriate form for Nautical Science. The pieces of evidence may be stored in files, folders, boxes, binders, exercise books, notebooks or a combination of these.

It is important that the evidence collected is sufficient and reflects current competence. The learner and assessor may plan the file jointly. The learner is responsible for submitting the evidence and the compilation of the file. The file must consist of a variety of assessment instruments and tools, e.g. assessment grid, rubrics, marking memoranda, checklists, rating scales etc Assessment methods and instruments must be selected according to competencies to be assessed.

APPENDIX A

IDEAS FOR ASSIGNMENTS AND RESEARCH TASKS

Grade 12 Topic 2	As a group, conduct research into the effects of pollution caused by ships on the environment of one of the following: oil, waste disposal, ballast water or dangerous cargo. Find out how the pollution is caused, the effect and possible preventative measures. Decide who the stakeholders are e.g. ship owner, ship's captain, environmental watch group, government official for the environment etc. Work out and present a role-play to the class of a debate or meeting between these role players where each presents their point of view. Write a report on the debate and place in your file
Grade 10 Topic 2	Draw up a poster to entice young school or university leavers to join the navy
Grade 11 Topic 2	Design an interview for a ship's captain to explain on radio the responsibilities, training, advantages and disadvantages of a career at sea. Either interview a real person or answer the questions yourself from information sourced from books or Internet.
Grade 10 Topic 2	Design and build a model of a ship using recycled materials, clay, wood, cardboard or any suitable materials
Grade 11 Topic 2	In a group plan a scenario of an emergency at sea. Act out the causes and procedures for dealing with the emergency.
Grade 10 Topic 1	Plan a coastal voyage between two geographical points
Grade 12 Topic 3	Write a weather report of a very bad tropical cyclone to be read on radio explaining the weather conditions and the effect they are likely to have on land and at sea
Grade 10 Topic 4	Create a comparison table that identifies the strengths and weaknesses of the various methods of communicating at sea.
Grade 12 Topic 4	You have to motivate to parliament for funds for the Global maritime Distress and Safety System. Write a speech explaining how the system works and why it is important.

APPENDIX B
BLOOM'S TAXONOMY

The following cognitive levels should be taken into consideration when designing assessment tasks, tests and examinations to allow for differentiation.

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
define describe identify label locate name recognise select state	compare define describe distinguish explain generalise illustrate infer interpret match paraphrase restate select summarise	adapt compute discover draw gather graph modify operate prepare revise show solve survey use	categorise classify compare contrast decipher deduce differentiate distinguish explain generalise infer predict relate solve	combine compose create depict design develop incorporate integrate invent organise plan predict produce structure	appraise critique decide evaluate judge justify recommend

APPENDIX C RESEARCH PROJECTS

These may be done individually, in pairs or in groups not larger than four. They may include a practical and/or oral presentation, but must be accompanied by a written presentation. Generic skills needed to be developed and assessed from Grades 10 to 12.

Cognitive/thinking skills Bloom's categories	Motor/Process skills	Life skills
Knowledge Comprehension Application Analysis Synthesis Evaluation	Follow instructions Designing procedures/action plan Access information from various sources Observational skills Writing skills Drawing conclusions	Ability to work in groups Ability to work independently Creativity, initiative, interest, attitude Managerial skills; ability to plan/organize/divide tasks/ time management Communication skills: report back - oral skills

To develop skills in doing projects and assignments, the teacher should develop learners from Grade 10 by guiding the process step by step. By the time learners are in Grade 12, they must be able to do projects independently due to the time factor.

When giving a project in Grade 10 and 11:

1. The teacher gives the topic and negotiates the steps and time frames with the learners.
2. Brainstorm the topic together. Discuss the action plan and procedures - where and how to get information.
3. Collect information relevant to the topic. Use textbooks, encyclopaedias, interviews, magazines, newspapers, etc. Learners must understand and know terminology/content.
4. Divide the topic into smaller steps. Allocate tasks, timeframes and marks. Plan who will assess and develop the assessment instrument.

Projects should be a maximum of 2000 words (about 6 handwritten pages or 4 typed pages) for with 12 font, single-spaced, bound or stapled and should include:

- A front page
- Table of contents
- Text divided into paragraphs
- References of sources
- Pictures/ photos/ diagrams/ graphs

A standardised marking scheme would imply that when a particular skill is being assessed, all teachers follow the same criteria, and standards would be more comparable.

Penalties

- **While learners are encouraged to use the Internet as a resource tool, plagiarized work should earn a zero. This applies to materials plagiarized from books and other media.**
- Late submission of work should be penalised at the rate of 10% of the marks per day unless permission is granted by the teacher prior to the submission date or on the presentation of a doctor's certificate.

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Exemplar of an Assessment of a Research Project using marks		
Candidate: _____ Assessor _____		
School _____ Date _____		
Assessment Criteria	Rating	Possible total
Content & Topic: Level of information – detailed relevant, informed Variety of Sources – varied, bibliography Topic – challenging, original		20
Interpretation: Creative and insightful use of the information that shows a good understanding of the topic		20
Use of Language: Personalised, fluent, articulate, clear		20
Aims & Conclusion: Successfully addresses the objectives set out in the topic Brings the essay to a successful conclusion		20
Accuracy: Of information and grammar		10
Presentation: Neat, ordered lay out, type, effort, clarity, illustrations – useful, necessary		10
Total		100
Comments:		

Alternatively Levels of Achievement which could be converted into marks

KEY	DESCRIPTION
1	Not Yet
2	Very superficial, disorganised, lacking insight
3	Completely descriptive, superficial, lacking in detail, missing the focus of the assignment
4	Slightly more descriptive than critical and answered with understanding, analysis vague at places,
5	Good critical and concept analysis, focused work
6	Excellent critical and concept analysis, stays very focused
7	Beyond expectation

**APPENDIX D:
EXAMPLES OF DAILY ASSESSMENT TASKS**

Example 1

Grade 11 Learning Outcome 1: Navigation: Sailings

You are the navigator aboard the MV SOUTHERN STAR which is busy loading cargo in Cape Town (33° 54' S 18° 25' E), bound for Baltimore (39° 16' N 76° 34' W). Your vessel is due to sail at 0700 B on 7 June and you hope to maintain a steady speed of 16 knots.

Determine:

- a. By Mercator sailing, the course you must steer and the distance you will cover between Cape Town and Baltimore. (12)
- b. Your estimated time of arrival in Baltimore in American zone time. (8)

<u>Latitude</u>	<u>Meridional Parts</u>
33° 54'	2151.19
39° 16'	2550.74

Memorandum

Cape Town Lat:	33° 54' S	mp:	2151.19	Long:	18° 25' E
Baltimore Lat:	39° 16' N	mp:	2550.74	Long:	76° 34' W
D.Lat:	73° 10' N	dmp:	4701.93	D.Long:	94° 59' W
	4390' N				5699' W

Tan course = D.long/dmp
 = 5699/4701.93
 = 1.212055475

Course = N 50.5° W (50° 28' 33")
 = 309.5° (T)

Distance = D.lat/cos course
 = 4390/cos 50° 28' 33"
 = 6898.1 nautical miles (12)

Time = Distance/ speed
 = 6898.1/16
 = 431.13 hours
 = 17 days 23 hours 8 minutes

ETD Cape Town = 070700 B June
 Zone (-2) = 000200
 ETD (GMT) = 070500 Z June
 Sailing time = 172308
 ETA (GMT) = 250408 Z June
 Zone (+5) = 000500
 ETA Baltimore = 242308 R June (8)

Method of assessment: Teacher, peer or self assessment
Assessment tool: Memorandum

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Example 2

Grade 11 Learning Outcome 2 Seamanship : Emergency procedures

You are officer of the watch aboard MV STARLIGHT. You are sailing on a course of 270° (T) at a speed of 16 knots. There are a number of other vessels within 5 miles of you. The lookout reports “Man overboard starboard side”. List the actions you will carry out in the order of importance.

(11)

Memorandum

1. Put the helm hard over to starboard.
2. Launch a lifebuoy with automatic smoke/light generator over the starboard side.
3. Detail the bridge lookout and any other spare hand on the bridge to keep the lifebuoy in sight.
4. Mark your position on the chart.
5. Sound three short blasts on the ship’s siren.
6. Hoist flag OSCAR.
7. Reduce speed (to 5 knots).
8. Inform
 - The captain.
 - The engine room.
 - The ship’s company via the ship’s broadcast system.
9. Carry out a Williamson turn and steady up on 090° (T) (the reciprocal of your initial course).
10. Order the bosun to prepare the seaboat for launching.
11. Stop upwind of the man and launch the seaboat.

(11)

Method of assessment: Teacher, peer or self assessment
Assessment tool: Memorandum

APPENDIX E
EXAMPLE OF A FORMAL ASSESSMENT TASK

Grade 12: Astro Calculation and Plotting Task

Navigation : Sun-run-Mer Alt-run-Sun

On 1 November in DR position $46^{\circ} 00' S$ $56^{\circ} 24.0' E$, you take an altitude of the lower limb of the sun at 0830 D. The sextant reads $36^{\circ} 18.0'$. The index error of the sextant is $2.4'$ off the arc whilst the height of eye on the bridge is 9 metres. Your course is 120° (T) and your speed is 20 knots.

Determine the bearing and intercept of the sun and plot the resultant position line on the chart.

At meridian passage of the sun later that day, another altitude of the sun's lower limb is taken with the sextant reading $57^{\circ} 40.8'$. The index error and height of eye remain the same.

Plot the course of the ship since 0830 D, calculate the DR position at meridian passage and plot it on the chart.

Determine the ship's latitude at meridian passage, transfer the 0830 position line and plot the resultant fix.

At 1530 D that afternoon, you take a third altitude of the sun's lower limb, with the sextant reading $33^{\circ} 13.2'$. Index error and height of eye remain unchanged.

Plot the ship's course from the midday fix, calculate the DR position of the ship at 1530 D and plot it on the chart.

Determine the bearing and intercept of the sun and plot the resultant position line on the chart. Transfer the midday position line and plot the ship's position at 1530 D.

Allocation of marks for plotting: 21

Allocation of marks for calculations: 75

Memorandum

Zone time = 0830 D
Zone (-4) = 0400
GMT = 0430 Z

GHA (0800)	=	244° 06'	Dec	=	S 14° 25.3'
Increment	=	<u>7° 30'</u>	'd'	=	<u>+ 0.4'</u> (0.8')
GHA (0830)	=	251° 36'	Dec	=	S 14° 25.7'
Long (E)	=	<u>56° 24'</u>			
LHA	=	308° 00'			

Sin Cal Alt = $\text{Cos } 308^{\circ} \times \text{Cos } 46^{\circ} \times \text{Cos } 14^{\circ} 25' 42'' + \text{Sin } 46^{\circ} \times \text{Sin } 14^{\circ} 25' 42''$
= 0.59342263

Cal Alt = $36^{\circ} 24'$ ($36^{\circ} 24' 01''$)

Sext alt = $36^{\circ} 18.0'$

IE = + 2.4'

Obs alt = $36^{\circ} 20.4'$

Dip = - 5.3'

App alt = $36^{\circ} 15.1'$

Total correct = + 14.9'

A = 0.81 N

B = 0.33 S

C = 0.48 N

Az = N 71.6° E

True brg = $071\frac{1}{2}^{\circ}$ (T)

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True alt	=	36° 30.0'
Cal Alt	=	<u>36° 24.0'</u>
Intercept	=	6.0 miles towards
LMT mer pass	=	1144
Long (E)	=	<u>0351</u>
GMT	=	0753 Z
Zone (-4)	=	<u>0400</u>
Zone time	=	1153 D

DR position at mer pass = 46° 32.5' S 57° 45' E

Sext alt	=	57° 40.8'	Dec	=	S 14° 27.7'
IE	=	+ 2.4'	'd'	=	+ 0.7'
Obs alt	=	<u>57° 43.2'</u>	Dec	=	<u>S 14° 28.4'</u>
Dip	=	- 5.3'			
App alt	=	<u>57° 37.9'</u>			
Total correct	=	+ 15.5'			
True alt	=	57° 53.4'			

ZX	=	90° - 57° 53.4'
	=	32° 06.6'
Dec	=	<u>14° 28.4'</u>
Latitude	=	46° 35' S

Position at 1153 D = 46° 35' S 57° 58.5' E

DR position at 1530 D = 46° 11.8' S 59° 31.6' E

Zone time	=	1530 D
Zone (-4)	=	<u>0400</u>
GMT	=	1130 Z

GHA (0800)	=	349° 06.1	Dec	=	S 14° 30.9'
Increment	=	<u>7° 30'</u>	'd'	=	+ 0.4' (0.8')
GHA (0830)	=	356° 36.1'	Dec	=	<u>S 14° 31.3'</u>
Long (E)	=	<u>59° 31.6'</u>			
LHA	=	416° 07.7'			
	=	<u>360° 00.0'</u>			
	=	56° 07.7'			

Sin Cal Alt = $\cos 56^\circ 07.7' \times \cos 47^\circ 11' 48'' \times \cos 14^\circ 31' 18'' + \sin 47^\circ 11' 48'' \times \sin 14^\circ 31' 18''$
 = 0.550664217
 Cal Alt = 33° 24.7' (33° 24' 45")

Sext alt	=	33° 13.2'	A	=	0.72 N
IE	=	+ 2.4'	B	=	<u>0.31 S</u>
Obs alt	=	<u>33° 15.6'</u>	C	=	0.41 N
Dip	=	- 5.3'			
App alt	=	<u>33° 10.3'</u>	Az	=	N 74.4° W
Total correct	=	+ 14.8'	True brg	=	285.6° (T)
True alt	=	33° 25.1'			
Cal Alt	=	<u>33° 24.7'</u>			
Intercept	=	0.4 miles towards			

Position at 1530 D = 47° 12' S 59° 30.1' E

APPENDIX F
ASSESSMENT TERMINOLOGY

From Department of Education
20 04 06

TERMINOLOGY	EXAMPLES
Types of assessment (X4)	Formative assessment, Summative assessment, Baseline assessment and Diagnostic assessment
Methods of assessment – <i>i.e. who is carrying out the assessment</i> (X4)	Teacher assessment, Self-assessment, Peer assessment and Group assessment
Methods of collecting evidence (X3)	Observation-based assessment, Test-based assessment and Task-based assessment
Forms of Assessment	Assignment, Aural test, Case study, Examinations, Multiple response questions, Demonstrations, Role plays, etc.
Tools for assessing learner performance	Rubrics, Rating scales, Checklists, Observation sheets, Marking memoranda, Assessment grids, etc.
Recording tools	Class list, Mark sheet, Promotion schedule, etc.
Reporting tools	Report card using competence descriptions, Teacher-parent interview, Teacher-learner interview, Written comments in learner work books, etc.

Assessment:	Gathering of evidence to make a judgement or describe the status of learning of an individual or group.
Assessment for learning:	Formative or diagnostic assessment, which aims to monitor and improve the teaching and learning process.
Assessment of learning:	Assessment which serves as a basis for documenting the extent to which the learner mastered the topics for the unit of study / work. Assessment for the purposes of promotion and certification.
Assessment form:	Refers to the kind of assessment instrument used in relation to the topics. A variety of assessment forms are used to ensure a fair assessment process.
Assessment method:	Refers to the activity that an assessor engages in, as he/she assesses a learner and the learner's work.
Assessment instrument:	Refers to the nature of the assessment task or activity given to the learner to do as well as the relevant criteria used to assess the learner's performance.
Day-by-day Assessment:	It is a problem-solving exercise done in class with clear guidelines and of specified length. Assignments are less open-ended than projects.
Fairness:	An assessment should not in any way hinder or advantage a learner.
Learner File:	Collection of different types of evidence, which relates to work being assessed.

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Performance Assessment	A task based on problem solving involving investigation designing, making, evaluating and communicating. The this task in done over a period of time. The essential focus of this task is to test practical competency practical; the work being carried out under supervision of the teacher.
Recording:	Recording involves the detailed record keeping of a learner's performance to monitor the learner's progress and to work out methods that can improve the learner's development.
Reporting:	This involves presenting information about the learner to the learner and his/ her parents/ guardian. This information is selected from the teacher's records and is presented in such a way that it reflects the learner's progress in achieving the required outcomes.
Reliability:	Reliability in assessment is about consistency. Consistency refers to the same judgement being made in the same, or similar contexts each time a particular assessment for specified stated intentions is administered.
School-based Assessment:	Schools internally assess learning continuously/ on an ongoing basis.
Teacher's File:	contains all the instructions and assessment criteria and rubrics pertaining to all the internal assessment tasks set for the learners.
Validity:	Assessment procedures, methods, instruments and materials have to match what is being assessed.