

## **SQA Advanced Unit Specification**

### **General information**

**Unit title:** Applied Marine Meteorology (SCQF level 8)

**Unit code:** HW76 48

**Superclass:** RF

**Publication date:** November 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### **Unit purpose**

This unit is about interpreting and evaluating meteorological, climatological and oceanographic data, with the objective of forecasting the weather and sea conditions that may be encountered during a voyage. It is primarily aimed at learners who intend to seek sea-going employment as a Merchant Navy Deck Officer. However it could also be studied by someone with an interest in the subject area.

### **Outcomes**

On successful completion of the unit the learner will be able to:

- 1 Analyse the major features of surface synoptic charts.
- 2 Analyse the features of the major global climate zones.
- 3 Analyse surface oceanographic processes and data.
- 4 Evaluate the effect of meteorological and climatological processes on passage planning.

### **Credit points and level**

1.5 SQA Credits at SCQF level 8: (12 SCQF credit points at SCQF level 8)

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### Recommended entry to the unit

Access to this unit is at the discretion of the centre. However it would be beneficial if learners had achieved either a UK Maritime and Coastguard Agency (MCA) Officer of the Watch Certificate or equivalent, or the SQA Advanced Certificate in Nautical Science, or the SQA Advanced Unit *Marine Meteorology: An Introduction (HW6R 48)*.

### Core Skills

Achievement of this unit gives automatic certification of the following Core Skills component:

Complete Core Skill	None
Core Skill component	Critical Thinking at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

### Context for delivery

If this unit is delivered as part of a group award, it is recommended that it should be taught and assessed within the subject area of the group award to which it contributes.

### Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## **SQA Advanced Unit Specification: Statement of standards**

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Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

Where evidence for outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### **Outcome 1**

Analyse the major features of surface synoptic charts.

#### **Knowledge and/or skills**

- ◆ Major features of surface charts
- ◆ Development of surface pressure systems
- ◆ Movement of surface pressure systems
- ◆ Decay of surface pressure systems
- ◆ Weather conditions associated with types of surface pressure systems

### **Outcome 2**

Analyse the features of the major global climate zones.

#### **Knowledge and/or skills**

- ◆ Major global climate zones
- ◆ Weather conditions associated with the major climate zones

### **Outcome 3**

Analyse surface oceanographic processes and data.

#### **Knowledge and/or skills**

- ◆ Oceanographic processes that drive surface ocean currents
- ◆ Oceanographic data
- ◆ Oceanographic conditions that may be encountered during a voyage

### **Outcome 4**

Evaluate the effect of meteorological and climatological processes on passage planning.

#### **Knowledge and/or skills**

- ◆ Ocean weather routing of ships
- ◆ Presentation of meteorological and climatological data
- ◆ Weather and sea conditions that may be encountered during a voyage

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### **Evidence requirements for this unit**

Practical evidence is required for Outcome 1 under supervised open-book conditions. Outcomes 2, 3 and 4 may be combined and assessed in a three hour single open-book written and/or recorded oral assessment under supervised conditions with access to weather data extracts from admiralty sailing directions, mariner's handbook, ocean passages for the world, routing charts and weather reports from meteorological services.

All knowledge and skills are assessed, however there is sampling within each of the knowledge and skills.

#### **Outcome 1**

Learners will be provided with a series of synoptic charts and asked to construct weather forecasts based on the information shown on the charts, using practical exercises under supervised open-book conditions and with access to course notes.

Learners will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- 1 Analyse the major features of surface charts establishing the factors that affect the development, decay and movement of surface and upper air pressure systems including:
  - (a) Frontal and non-frontal depressions
  - (b) Troughs
  - (c) Anticyclones
  - (d) Ridges
  - (e) Cols
  - (f) Frontogenesis and frontolysis
  
- 2 Analyse the weather conditions associated with surface pressure systems including:
  - (a) Frontal and non-frontal depressions
  - (b) Troughs
  - (c) Anticyclones
  - (d) Ridges
  - (e) Cols

Different series of synoptic charts must be used in each assessment occasion.

#### **Outcome 2**

Learners will be provided with weather data and be required to analyse the information using a written and/or oral recorded assessment under supervised open-book conditions.

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Learners will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- 1 Analyse the features of the major climate zones establishing the factors that affect the development of the zones including:
  - (a) Inter-Tropical Convergence Zone (ITCZ)
  - (b) Trade winds
  - (c) Polar front
  - (d) Monsoons
  - (e) Jetstreams
  - (f) Rossby waves
  - (g) Tropical Revolving Storms (TRS)
  - (h) El-Nino
  
- 2 Analyse the weather conditions associated with major climate zones for a sample of three from the following:
  - (a) ITCZ
  - (b) Trade winds
  - (c) Polar front
  - (d) Monsoons
  - (e) TRS
  - (f) El-Nino

Different weather data and/or scenario must be used on each assessment occasion.

Where sampling is used a different sample must be used on each assessment occasion.

### Outcome 3

Learners will be provided with weather data and be required to analyse the information using a written and/or recorded oral assessment under supervised open-book conditions.

Learners will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- 1 Analyse and explain the processes that affect the development of the major ocean surface currents.
- 2 Analyse the characteristics of the major ocean currents.
- 3 Analyse the origins of wind, swell and extreme storm waves.
- 4 Describe each of the following:
  - (a) the main types of floating ice
  - (b) the origins of floating ice
  - (c) the distribution of floating ice
  - (d) the expected movement of floating ice
  - (e) nomenclature of floating ice

Different weather data and/or scenario must be used on each assessment occasion.

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### Outcome 4

Learners will be provided with weather data and be required to analyse the information using a written and/or recorded oral assessment under supervised open-book conditions.

Learners will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- 1 Evaluate the different types of weather routeing for a sample of one from the following:
  - (a) Least time
  - (b) Least damage
  - (c) Least time least damage
  - (d) Fuel saving
  - (e) Towing
- 2 Analyse the process of construction of a least time weather route.
- 3 Describe methods used to present meteorological and climatological data for the following:
  - (a) Ocean current data for a sample of one from the following:
    - (i) Vector mean
    - (ii) Predominant current
    - (iii) Current rose
  - (b) Wave data
  - (c) Routeing chart
  - (d) Ice data
- 4 Estimate the weather and sea conditions that may be encountered during a voyage using following meteorological and climatological data:
  - (a) Ocean current data
  - (b) Wave data
  - (c) Routeing chart
  - (d) Ice data
    - (i) Analyse the conditions that may cause ice accumulation on ships.
    - (ii) Evaluate the factors controlling the accumulation.
    - (iii) Estimate rates of accumulation using data provided.

Different weather data and/or scenario must be used on each assessment occasion.  
Where sampling is used a different sample must be used on each assessment occasion.

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### SQA Advanced Unit support notes

**Unit title:** Applied Marine Meteorology (SCQF level 8)

Unit support notes are offered as guidance and are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 60 hours.

#### Guidance on the content and context for this unit

The content of this unit forms part of the underpinning knowledge for a UK MCA *Chief Mate Certificate of Competency* and accordingly reflects the content of International Maritime Organisation's *Standards of Training Certification and Watchkeeping (STCW)*.

The unit is primarily intended for learners who are new entrants to the Merchant Navy via one of the Merchant Navy Training Board (MNTB) approved deck cadet training schemes or for seafarers who are enrolled on a Chief Mates/Master course. Ideally learners would have already accrued some shipboard experience prior to attempting this unit, although this is not a prerequisite.

The knowledge and skills contained within the unit cover all the requirements as laid down in Table A-II/2 of STCW 2010 at management level aboard ship.

Completion of the unit will also ensure that the learner complies with all the requirements laid down by the UK MCA for the issue of a Chief Mate's Unlimited Certificate of Competence as a Deck Officer. The required knowledge and skills for MCA Certification can be found in a document detailing the requirements for the issue of an Education and Training Certificate (C&D), which is available from the MNTB.

The following notes give additional information on the knowledge and skills for each of the four outcomes.

#### Outcome 1

This outcome enables the learner to identify the major features on a synoptic chart including depressions, troughs, anticyclones, ridges, cols, frontolysis and frontogenesis. They will then be able to construct weather forecasts based on a set of synoptic charts covering a period of up to four days.

#### Outcome 2

The factors that affect the development of the major global climate zones will be discussed. This will include the pressure distribution at the ITCZ, the formation of the trade winds and the polar front. The factors which affect the formation of the jetstreams will also be explored along with the relationship between the jetstreams and the monsoons.

The weather associated with the ITCZ, trade winds, polar front and the monsoons will be investigated.

The formation and flow of Rossby waves in the upper atmosphere will be investigated in conjunction with the effect that these waves have on the surface weather patterns.

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The factors that govern the formation of TRSs will also be discussed as will the implications that these weather systems have on ships at sea.

The El-Nino effect will also be explored. This will include the effect that this phenomenon has on both changes in global weather patterns and on surface current flow.

### Outcome 3

This outcome will enable the learner to understand the principles that govern the formation of surface ocean currents. The global flow pattern and characteristics of the surface currents will be discussed.

The formation of wind, swell and extreme storm waves will also be explored as will the effect that such waves have on ships.

The formation of the main types of floating ice will be investigated along with the distribution and movement of the ice.

### Outcome 4

This outcome will enable the learner to evaluate the effect of meteorological and climatological processes on passage planning. The various forms of weather routing will be discussed and the formation of a 'least time' weather route will be investigated.

The various ways in which current and wave data is presented will also be explored as will the method used to present ice data on routing charts. Learners will use this information to investigate the effect and implication of waves and current on ship's speed.

The use and advantages versus disadvantages of climate routing charts will also be discussed.

The conditions and factors that may cause ice accretion to take place on ships will be investigated along with the factors that control the accumulation rates.

## Guidance on approaches to delivery of this unit

Learners will benefit most if this unit is delivered in conjunction with the following SQA Advanced Units: *Marine Passage Planning* and *Management of Bridge Operations*. The knowledge and skills developed within the unit should be applied in the context that will be encountered aboard ship, ideally leading the learner towards the ability to:

- ◆ Understand the elements and process which determine weather, draw conclusions on the basis of observations made on board and from available weather data.
- ◆ Take into account climatic conditions, the weather prognosis, ocean currents and information on the presence of ice, for the safe operation of the ship. Evaluate the effect of meteorological and climatological processes on passage planning.
- ◆ Understand and interpret a synoptic chart, predict area weather, have a knowledge of the characteristics of various weather systems and ocean current systems and be able to use all appropriate navigational publications.

Centres are advised to provide up-to-date shipboard navigational publications and relevant weather data to learners. Wherever possible case study, activities, group work, ICT should be used to deliver this unit.



### Guidance on approaches to assessment of this unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Outcome 1 will be assessed by an open-book practical exercise under supervised conditions with access to course notes. Different series of synoptic charts must be used in each assessment occasion.

Outcomes 2, 3 and 4 may be combined and assessed in a three hour single open-book written assessment consisting of short answer and structured type of questioning and administered under supervised conditions with access to weather data extracts from admiralty sailing directions, Mariner's handbook, Ocean passages for the world, Routing charts and weather reports from meteorological services. Different weather data and/or scenario must be provided on each assessment occasion. Where sampling is used a different sample must be used on each assessment occasion.

Where possible, centres are recommended to conduct holistic assessment or integration of assessment.

Authentication of the learners work is achieved by the action of double marking, a percentage of papers are double marked for authenticity. The learner can also ask for his work to be double marked at any time. The internal quality verification is carried out before each assessment to maintain the fairness of the assessment. On top of this internal verification should be carried out to ensure all assessments are verified to a fair standard. It is recommended that the assessment of this unit is carried out by separately assessing Outcome 1 and combining Outcomes 2, 3 and 4. Questions should be based on the relevance of the topic to the role of Merchant Navy Deck Officer at sea.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

This unit has the Critical Thinking component of Problem Solving embedded in it. This means that when learners achieve the unit, their Core Skills profile will also be updated to show they have Critical Thinking at SCQF level 6.

The unit will also provide learners with the opportunity to develop the Core Skill of *Numeracy*: Using Graphical Information at SCQF level 6.

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Using Graphical Information at SCQF level 6 is developed as the learner uses graphical information to determine geostrophic wind speeds, ice accumulation rates and the effect of waves on ship's speed. Learners also have to construct a graphical representation of a weather route.

*Communication:* Reading and Writing at SCQF level 6 skills are developed throughout the unit and *Information and Communication Technology* (SCQF level 6) skills are acquired as learners use the internet to investigate online weather services and weather education sites. Online tutorials are also utilised.

## History of changes to unit

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

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### General information for learners

**Unit title:** Applied Marine Meteorology (SCQF level 8)

This unit is about interpreting and evaluating meteorological, climatological and oceanographic data, with the objective of forecasting the weather and sea conditions that may be encountered during a voyage. It is primarily aimed at learners who intend to seek sea-going employment as a Merchant Navy Deck Officer. However it could also be studied by someone with an interest in the subject area.

On completion of the unit you should be able to:

- 1 Analyse the major features of surface synoptic charts.
- 2 Analyse the features of the major global climate zones.
- 3 Analyse surface oceanographic processes and data.
- 4 Evaluate the effect of meteorological and climatological processes on passage planning.

You will be assessed using two assessment events. Outcome 1 will be assessed by an open-book practical exercise under supervised conditions with access to course notes. Different series of synoptic charts must be used in each assessment occasion.

Outcomes 2, 3 and 4 may be combined and assessed in a three hour single open-book written assessment consisting of short answer and structured type of questioning and administered under supervised conditions with access to weather data extracts from admiralty sailing directions, mariner's handbook, ocean passages for the world, routing charts and weather reports from meteorological services.

This unit has the Critical Thinking component of Problem Solving embedded in it. This means that when you achieve the unit, your Core Skills profile will also be updated to show you have Critical Thinking at SCQF level 6.

The unit provides you with the opportunity to develop the Core Skill of *Numeracy* by interpreting complex graphical information and data to draw conclusions and forecast weather.

The unit also provides the opportunity to develop the Core Skill of *Communication* including the use of ICT throughout the unit.