



## Higher National Unit Specification

### General information

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

**Unit code:** HT6M 34

**Superclass:** XQ

**Publication date:** July 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This unit introduces the learner to marine meteorological observing methods, codes and the weather services available to shipping. It develops knowledge of meteorological processes and the identification of and weather associated with, the main synoptic systems as well as knowledge of the circulation of the atmosphere and oceans. 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 Describe meteorological observing methods, use of meteorological instruments, use of world meteorological organization (WMO) codes and weather services available to shipping.
- 2 Explain meteorological processes.
- 3 Identify and describe the weather associated with the main features of a synoptic chart.
- 4 Describe the general circulation of the atmosphere, the main climatic zones over the oceans and the ocean currents of the world.

### Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

## **Higher National Unit Specification: General information (cont)**

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

### **Recommended entry to the unit**

Access to this unit is at the discretion of the centre. However learners would benefit most from this unit if they have successfully completed the Marine Induction Course associated with the HNC/HND Nautical Science.

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the support notes for this unit specification.

There is no automatic certification of Core Skills or Core Skill components in this unit.

### **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).

# Higher National Unit Specification: Statement of standards

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

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

Describe meteorological observing methods, use of meteorological instruments, use of world meteorological organisation (WMO) codes and weather services available to shipping.

### Knowledge and/or skills

- ◆ Meteorological instruments
- ◆ Beaufort scale
- ◆ The organisation of the WMO
- ◆ Weather services available to shipping
- ◆ Non-instrument meteorological observations

## Outcome 2

Explain meteorological processes.

### Knowledge and/or skills

- ◆ Meteorological characteristics of the troposphere
- ◆ Characteristics and causes of geostrophic and surface winds
- ◆ Processes of formation of cloud and precipitation
- ◆ Causes of reduced horizontal visibility

## Outcome 3

Identify and describe the weather associated with the main features of a synoptic chart.

### Knowledge and/or skills

- ◆ Surface charts
- ◆ Main synoptic patterns
- ◆ Air masses
- ◆ Weather associated with the main synoptic patterns

## Outcome 4

Describe the general circulation of the atmosphere, the main climatic zones over the oceans and the ocean currents of the world.

## Higher National Unit Specification: Statement of standards (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

### Knowledge and/or skills

- ◆ General circulation of the atmosphere
- ◆ Main climatic zones over the oceans
- ◆ Ocean currents of the world

### Evidence requirements for this unit

Learners will need to provide written and/or oral recorded evidence in open-book supervised conditions. Outcomes 1, 2, 3 and 4 should be combined into one single assessment lasting no longer than two hours.

Outcomes 1, 2, 3 and 4 may be assessed by means of a single unseen assessment using MCA approved data sheets, weather charts under open-book supervised conditions.

Suitable surface charts will be provided to the learner.

### Outcome 1

For Outcome 1 three out of five knowledge and skills should be sampled. A different sample should be used on each assessment occasion.

Learners are required to provide written and/or oral recorded evidence to demonstrate their knowledge and/or skills by showing they can:

- 1 Describe the principles and use of the following instruments:
  - ◆ Aneroid and precision aneroid barometers
  - ◆ Barograph
  - ◆ Mason's hygrometer, marine screen and whirling psychrometer
  - ◆ Sea temperature apparatus
- 2 Use the Beaufort scale. Learners should be required to evaluate the wind Beaufort scale.
- 3 Describe the principles of non-instrumental meteorological observations of:
  - ◆ Waves
  - ◆ Wind (true and apparent)
  - ◆ Horizontal visibility
  - ◆ Types of cloud

Learners will be required to identify clouds from photographs of different clouds.

- 4 Explain the organisation of WMO and the observing network and discuss the process of coding ships' meteorological observations.

## Higher National Unit Specification: Statement of standards (cont)

### Unit title: Marine Meteorology: An Introduction (SCQF level 7)

- 5 Describe the weather services available to shipping.

Learners should be able to describe the types of weather bulletins and surface charts available to the mariner and the methods of transmission and availability.

#### Outcome 2

For Outcome 2 a minimum of two out of ten knowledge and skills should be sampled. A different sample should be used on each assessment occasion.

Learners are required to provide written and/or oral recorded evidence to demonstrate their knowledge and/or skills by showing they can:

- 1 Explain the structure of and describe the methods of heating and cooling of the troposphere.

This must include the variation of surface temperatures, environmental lapse rate and its variation including temperature inversions.

- 2 Define pressure, pressure units and isobars.

- 3 Explain geostrophic and surface winds and the forces producing both winds.

This must include pressure gradient, pressure gradient force, Coriolis force, cyclostrophic force and friction.

- 4 Describe the use of the geostrophic wind scale and Buys Ballot's Law.

- 5 Explain the formation of one of the following; land breeze, sea breezes or katabatic winds.

- 6 Explain changes of state of water in the atmosphere, latent heat, adiabatic temperature changes and atmospheric stability.

- 7 Explain methods of cloud formation as related to atmospheric stability, cloud decay.

This should be sampled from either stable or unstable cloud formation.

- 8 Describe one type of precipitation and its processes of formation.

- 9 Explain the formation from a sample of one of the following:

Advection fog, radiation fog, mist haze.

- 10 Explain the formation of dew and frost.

## Higher National Unit Specification: Statement of standards (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

### Outcome 3

For Outcome 3 a minimum of two out of three knowledge and skills should be sampled. A different sample should be used on each assessment occasion.

Learners are required to provide written and/or oral recorded evidence to demonstrate their knowledge and/or skills by showing they can:

- 1 Identify and describe the weather associated with the main synoptic patterns and features on a surface chart.

On each assessment occasion the following must be assessed:

- (i) Frontal depressions including families and secondary depressions.
- (ii) Non-frontal depressions and non-frontal troughs.
- (iii) Anticyclones.
- (iv) Ridges of high pressure

- 2 Identify and describe the weather associated with air masses on a surface chart from a sample of one of the following:

- ◆ Polar
- ◆ Tropical
- ◆ Arctic
- ◆ Antarctic air masses.

- 3 Identify and describe the causes of local winds on a surface chart from a sample of one of the following:

- ◆ NE Monsoon
- ◆ SW Monsoon

### Outcome 4

For Outcome 4 a minimum of two out of four knowledge and skills should be sampled. a different sample should be used on each assessment occasion.

Learners are required to provide written and/or oral recorded evidence to demonstrate their knowledge and/or skills by showing they can:

- 1 Identify and describe the pressure distribution and prevailing winds in either January or July.
- 2 Describe the characteristics and location of the main climatic zones over the oceans.

Learners will have to indicate the main climatic zones on a world map and should describe the characteristics of one zone which has been indicated. A different zone should be used on each assessment occasion.

## Higher National Unit Specification: Statement of standards (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

- 3 Identify the principal surface ocean currents of either the Pacific or Atlantic ocean.

Learners should state whether the currents are warm or cold and indicate the direction of water flow.

- 4 Identify and describe the geographical areas and seasons where tropical revolving storms can occur.

On each assessment occasion learners will be required to indicate the areas affected on a map of the world. Learners must also state the season for each area and the local names used for a TRS.



## Higher National Unit support notes

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

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 40 hours.

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

The content of this unit reflects the content of International Maritime Organisation's Standards of Training Certification and Watchkeeping (STCW).

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

#### Outcome 1

This outcome enables learners to be able to use and understand the principles of several meteorological instruments, namely the barometer, barograph, Mason's hygrometer, marine screen, whirling psychrometer and sea temperature apparatus. In addition, learners will gain the knowledge to be able to use the Beaufort scale and make non-instrument observations of waves, wind, horizontal visibility and cloud types. The coding of meteorological observations mentioned above will also be investigated. The weather services available to shipping will be explored as will the organisation of the WMO.

#### Outcome 2

The structure of the troposphere will be investigated and the methods of heating and cooling within the troposphere will be discussed. This will include the variation of surface temperatures, environmental lapse rates and temperature inversions.

Learners will be able to define pressure, pressure units and isobars. The theory associated with geostrophic winds and gradient winds will be explored including the effect of Coriolis force, centrifugal force and friction. Learners will also be able to apply Buys Ballots Law and be able to use the geostrophic wind scale.

The formation of land and sea breezes will be explored as well as the formation of katabatic winds.

The changes of state of water within the environment and the hydrological cycle will be investigated along with latent heat, adiabatic temperature changes and atmospheric stability.

The methods of cloud formation as related to atmospheric stability will be discussed in addition to the formation of cloud and precipitation and causes of reduced visibility. The processes of the different types of formation of precipitation will be investigated as will the formation of dew and frost.

The formation of radiation and advection fog and mist will be explored in addition to the development of haze within the atmosphere.



## Higher National Unit support notes (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

### Outcome 3

Learners will be able to identify from a surface chart the major synoptic patterns including frontal depression, families and secondary depressions, non-frontal depressions, non-frontal troughs, anticyclones and ridges of high pressure. They will also be able to describe the weather associated with such synoptic patterns.

They will also be able to identify and describe the weather associated with polar, tropical, arctic and antarctic air masses.

The processes which cause the NE monsoon and SW monsoon to develop will be explored and learners will also gain a knowledge of the local weather conditions associated with the monsoon.

### Outcome 4

This outcome explores the general circulation of the atmosphere and examines the main climatic zones over the ocean. This includes the global pressure distribution and the prevailing winds during both January and July. The areas and season in which tropical revolving storms occur will also be investigated and learners will also be able to discuss the local names for these storms.

The name, location and direction of travel of the major oceanic currents will be examined and learners will also be able to classify, where appropriate warm or cold currents.

## Guidance on approaches to delivery of this unit

The knowledge and skills acquired in this unit will be practised extensively at sea so that the experience gained can be utilised in the HN Unit *Applied Marine Meteorology* and HN Unit *Marine Passage Planning* which feature in the later stages of the HND Nautical Science.

## 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.

Learners will need to provide written and/or oral recorded evidence in open-book supervised conditions. Outcomes 1, 2, 3 and 4 should be combined into one single assessment lasting no longer than two hours.

Elements of Outcomes 1, 2, 3 and 4 may be assessed by means of a single unseen assessment using MCA approved data sheets, weather charts under open-book supervised conditions and could consist of a mixture of short answer questions by sampling the elements of the outcomes. Elements of outcome may be combined where practical to assess the learners' ability to apply the knowledge gained from these outcomes.

## Higher National Unit support notes (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

A single assessment instrument covering all outcomes may have 3 items from Outcome 1 and two each from Outcomes 2, 3 and 4

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

### Outcome 1

Outcome 1 will be assessed on a sample basis by means of an assessment administered under supervised open-book conditions.

### Outcome 2

Outcome 2 will be sample assessed by open-book assessment under supervised conditions on meteorological processes. It is recommended that Outcome 2 be combined with Outcomes 3 and 4 for assessment purposes.

### Outcome 3

Outcome 3 will be sample assessed by open-book assessment under supervised conditions on the identification and description of the weather associated with the main synoptic patterns. It is recommended that Outcome 3 be combined with Outcomes 2 and 4 for assessment purposes.

Suitable surface charts will be provided to the learner.

### Outcome 4

Outcome 4 will be sample assessed by open-book assessment under supervised conditions on the general circulation of the atmosphere, the main climatic zones over the oceans and the ocean currents of the world. It is recommended that Outcome 4 be combined with Outcomes 2 and 3 for assessment purposes.

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

## 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).

## Higher National Unit support notes (cont)

**Unit title:** Marine Meteorology: An Introduction (SCQF level 7)

### Opportunities for developing Core and other essential skills

The unit will provide learners with the opportunity to develop the Core Skills of *Numeracy*, *Using Number* at SCQF level 5. Learners will develop the use of numbers through calculations involving several variables in order to calculate surface wind speeds and direction as well as relative humidity. Also the learner will learn to use vectors to calculate true wind speed and direction.

Using Graphical Information at SCQF level 6 is developed as the learner uses graphical information to determine geostrophic wind speeds, dew point temperature and humidity. The learner also learns to analyse the graphical information depicted on synoptic charts in order to construct weather forecasts. This also allows the learner to develop their problem solving, reviewing and evaluation (SCQF level 5) skills. These skills are also further developed as the learner builds a knowledge of the large scale meteorological and oceanographic processes.

*Communication* (Reading and Writing at SCQF level 5) skills are developed and *Using Information Technology* (SCQF level 5) skills are acquired as learners use the internet to investigate on-line weather services and weather education sites. On-line tutorials are also utilised.

## History of changes to unit

Version	Description of change	Date

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## General information for learners

### Unit title: Marine Meteorology: An Introduction (SCQF level 7)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

This unit is about marine meteorological observing methods, codes and weather services to shipping. It develops knowledge of meteorological processes and the identification of, and weather associated with, the main synoptic systems as well as knowledge of the circulation of the atmosphere and oceans.

On completion of this unit you should be able to:

- ◆ use meteorological observing methods, WMO codes and weather services available to shipping
- ◆ explain meteorological processes
- ◆ identify and describe the weather associated with the main features of a synoptic chart
- ◆ describe the general circulation of the atmosphere, the main climatic zones over the oceans and the ocean currents of the world

Whenever possible you should relate the above outcomes to your own experience. Your ability to take meteorological observations and use codes will be assessed by an open-book assessment under supervised conditions. Your knowledge of meteorological processes, weather systems and ocean currents may be assessed by open-book assessment under supervised conditions. The assessment may be short answer questions.

Elements of Outcomes 1, 2, 3 and 4 may be assessed by means of a single unseen assessment using MCA approved data sheets, weather charts under open-book supervised conditions consisting of a mixture of short answer questions by sampling the knowledge and skills of all the outcomes. Elements of the knowledge and skills may be combined where practical to assess your ability to apply the knowledge gained from these outcomes.

A single assessment instrument covering all outcomes may have three items from Outcome 1 and two each from Outcomes 2, 3 and 4 and the open-book supervised condition assessment should not normally exceed two hours.