

## SQA Advanced Unit Specification

### General information for centres

**Unit title:** Petroleum Geology and Geophysics: An Introduction

**Unit code:** HV4R 47

**Unit purpose:** The purpose of this unit is to introduce candidates to the geology required to understand the formation and location of hydrocarbon reservoirs, and the geophysical surveying techniques used to locate potential reservoirs.

On completion of the unit candidates should be able to:

- 1 explain the origins of hydrocarbons, basic petroleum traps and the main reservoir types and features
- 2 explain the geophysical methods and equipment used to locate potential reservoirs

**Credit points and level:** 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

**Recommended prior knowledge and skills:** Entry to this unit is at the discretion of the centre.

**Core skills:** There are opportunities to develop the Core skills of *Communication* and the Core Skills component of *Numeracy: Using Graphical Information* at SCQF level 5 and the Core Skills component of *Problem Solving: Reviewing and Evaluating* at SCQF level 4 in this unit, although there is no automatic certification of Core Skills or Core Skills components.

**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.

**Assessment:** Assessment for this unit can be undertaken either on an outcome by outcome basis using a completion of outcome test, or collectively, by using an end-of-unit test. The candidate will be expected to respond to questions allowing a demonstration of the relevant knowledge and skills items introduced throughout the unit. These questions may take the form of an appropriate balance of short-answer and extended-response questions.

If the assessment is by means of an end-of-unit test, then the time allocated for this test must not exceed the total time allowed for individual outcome assessments.

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

### **Unit title:** Petroleum Geology and Geophysics: An Introduction

The sections of the unit stating the outcomes, knowledge and/or skills, and evidence requirements are mandatory.

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. Candidates 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**

Explain the origins of hydrocarbons, basic petroleum traps and the main reservoir types and features

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

- ◆ Formation of hydrocarbons
- ◆ Structural events
- ◆ Petroleum migration and accumulation
- ◆ Reservoir types
- ◆ Reservoir traps

#### **Evidence requirements**

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

- ◆ explain how two of the following lead to the formation of hydrocarbons (oil and gas):
  - terrestrial and marine kerogens
  - depositional processes
  - maturation
  - biodegradation
- ◆ explain how three of the following structural events lead to the formation of petroleum traps:
  - stress
  - strain
  - folding
  - faulting
  - salt domes
  - unconformities
- ◆ explain how two of the following contribute to petroleum migration and accumulation:
  - mobility
  - water washing
  - biodegradation
  - percolation
  - evaporation
- ◆ describe the structure of one of these reservoir types:
  - sandstone
  - limestone
  - deltaic
  - fluvial
  - estuarine
- ◆ describe the structure of a reservoir traps

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This outcome will be assessed using an unseen, supervised closed-book assessment.

### Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short-answer and extended-response questions.

The assessment for this outcome can be combined with Outcome 2 to form a single assessment, details of which are given under Outcome 2.

## Outcome 2

Explain the geophysical methods used to locate potential reservoirs

### Knowledge and/or skills

- ◆ Field anomalies
- ◆ Seismic methods
- ◆ Field exploration

### Evidence requirements

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

- ◆ explain how 2 from 4 of the following methods:
  - remote sensing
  - gravitational
  - magnetic
  - seismicare used to locate potential offshore and onshore reservoirs.
- ◆ identify the sequence of steps involved in a field exploration, this should include:
  - map reading
  - aerial photography including satellite
  - field sampling
  - sample analysis

This outcome will be assessed using an unseen, supervised closed-book assessment.

### Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short-answer and extended-response questions.

The assessment of this outcome can be combined with Outcome 1 to form a single assessment. If an integrated instrument of assessment is used, this should be constructed in two sections, one for each outcome, comprising an appropriate balance of short-answer and restricted-response questions.

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### Administrative information

<b>Unit code:</b>	HV4R 47
<b>Unit title:</b>	Petroleum Geology and Geophysics: An Introduction
<b>Superclass category:</b>	RF
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#### History of changes:

Version	Description of change	Date

**Source:** SQA

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### SQA Advanced Unit Specification: support notes

#### Unit title: Petroleum Geology and Geophysics: An Introduction

This part of the unit specification is offered as guidance. The support notes 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

This unit is a mandatory unit within SQA Advanced Certificate and SQA Advanced Diploma in Petroleum Engineering. It is designed to provide candidates with an understanding of the fundamental geological processes which effect the formation of the main types of hydrocarbon reservoirs, and the geophysical surveying techniques used to locate their potential reservoirs.

#### Outcome 1

Explain the origins of hydrocarbons, basic petroleum traps and the main reservoir types and features.

Delivery for this outcome should commence with a brief exposition of the following:

- ◆ geological time periods
- ◆ stratigraphy
- ◆ lithology
- ◆ palaeontology
- ◆ rock types
  - Igneous
  - Metamorphic
  - Sedimentary
- ◆ hydrocarbon formation
  - terrestrial and marine kerogens
  - depositional processes
  - maturation
  - biodegradation
- ◆ structural events leading to the formation of petroleum traps
  - plate tectonics
  - stress
  - strain
  - folding
  - faulting
  - salt domes
  - unconformities
- ◆ petroleum migration and accumulations
  - mobility
  - water washing
  - biodegradation
  - percolation
  - evaporation

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- ◆ reservoir types
  - sandstone
  - limestone
  - deltaic
  - fluvial
  - estuarine
- ◆ reservoir traps

### Outcome 2

Explain the geophysical methods and equipment used to locate potential reservoirs.

The delivery of this outcome would include the following topics:

- ◆ differences in equipment and methods used
- ◆ effects of electrical, magnetic and gravitational fields
- ◆ seismic methods
  - acoustic
  - magnetic
  - zero phase
- ◆ field sampling and interpretation
  - map interpretation
  - aerial photography including satellite
  - field sampling
  - sample analysis

### Guidance on the delivery and assessment of this unit

This unit will probably be delivered as part of a group award designed to provide candidates with technical knowledge and skills for employment in the petroleum engineering industries.

While the use of case study material is particularly recommended for both learning and teaching components of this unit, other suggested teaching and learning methods for this unit could include: the use of visual aids, information communication technology (ICT), group lectures and discussion, practical demonstrations, question and answer sessions, directed study, industrial/site visits.

Formative work for this unit could include group discussion emphasising geologic and geophysical events specific to petroleum engineering. Such an approach could be beneficial to those candidates without industrial experience.

Assessment strategies for this unit could include:

#### Outcome 1

An appropriate balance of short-answer and extended-response questions addressing the evidence requirements for the outcome, carried out under unseen, closed-book and supervised conditions.

#### Outcome 2

An appropriate balance of short-answer and extended-response questions addressing the evidence requirements for the outcome. This would be carried out under unseen, closed-book and supervised conditions.

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It is recommended that a single assessment, combining the two outcomes, would have a total time allocated to it which does not exceed the individual time allocations given to assessments on an outcome by outcome basis.

### *Opportunities for developing Core Skills*

There are opportunities to develop the core skill of *Communication*, the Core Skills component of *Numeracy: Using Graphical Information* at SCQF level 5 and the Core Skills component of *Problem Solving: Reviewing and Evaluating* at SCQF level 4 in this unit, although there is no automatic certification of Core Skills or Core Skills components. This SCQF level 7 unit deals with complex information covering a range of geological systems and processes, which will require candidates to access a wide range of resources to support their learning. This will involve reading and interpreting information from textbooks as well as online resources. These learning, teaching approaches as well as the requirement for the assessment to contain some extended-response questions will allow candidates to develop *Problem Solving* Core Skills at SCQF level 4. The fact that much of the information will be in graphical form and that calculations will have to be carried out will ensure that candidates will be developing *Numeracy* at SCQF level 5.

### **Open learning**

If this unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance. A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes.

### **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).

## **General information for candidates**

### **Unit title:** Petroleum Geology and Geophysics: An Introduction

This unit is about describing the fundamental geological processes which effect the formation of the main types of hydrocarbon reservoirs, and the geophysical surveying techniques used to locate their potential reservoirs.

You are not expected to have any prior knowledge of geology or geophysics before attempting this unit. This knowledge will be introduced and developed within the unit.

You will gain knowledge and understanding of the following:

- 1 the physical processes and effects of main rock types will be introduced, in particular:
  - ◆ the structure and composition of the Earth
  - ◆ plate tectonics and continental drift
  - ◆ rock characteristics
  - ◆ geologic history
  
- 2 the origins of hydrocarbons, basic petroleum traps and the main reservoir types and features leading to an investigation of:
  - ◆ processes leading to the formation of hydrocarbons
  - ◆ structural events leading to the formation of petroleum traps
  - ◆ petroleum migration and accumulations
  - ◆ reservoir types and traps
  
- 3 the geophysical methods and equipment used to locate potential reservoirs, concentrating on:
  - ◆ offshore and onshore locations
  - ◆ seismic methods
  - ◆ field exploration methods

Assessments for this unit are likely to take the form of three end-of-outcome tests, or a single end-of-unit test covering all outcomes.