Higher National Unit specification

General information for centres

Unit title: Noise and Radioactivity

Unit code: F6JK 35

Unit purpose: This Unit provides an understanding of the nature and effects of noise and radioactivity, which can be applied in many subject areas and vocational contexts. On completion of this Unit, candidates, in addition to understanding the environmental significance of noise and radiological hazards, will have an appreciation of the relevant legislation, measurement techniques and control strategies in these areas.

On completion of the Unit the candidate should be able to:

1. Explain the nature, effects and measurement of noise.
2. Evaluate techniques and strategies to control noise emissions in a specific situation, in the context of legislation.
3. Explain the production of and properties of radioactivity and its measurement.
4. Explain the hazards, benefits and legislation associated with radioactivity.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**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 Access 1 to Doctorates.*

Recommended prior knowledge and skills: Entry is at the discretion of the centre. Although there is no specialist prior knowledge required for this Unit, it would be beneficial if the candidate had a basic grounding in science and an awareness of environmental issues. This knowledge and understanding may be evidenced by possession of the HN Unit F2G8 34 *Environmental Awareness* and the HN Unit F21J 24 *Chemistry and Physics for the Life Sciences*.

Core Skills: There are opportunities to develop the Writing component of the Core Skill *Communication*, the Using Numbers component of the Core Skill *Numeracy* and the Critical Thinking component of the Core Skill *Problem Solving*, all at SCQF level 6 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: Most of Outcome 1, all of Outcome 3 and the first Evidence Requirements of Outcome 4 could be assessed together by means of a single closed-book test. The remaining Evidence Requirements could be assessed by two short separate reports.

Higher National Unit specification: statement of standards

Unit title: Noise and Radioactivity

Unit code: F6JK 35

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 nature, effects and measurement of noise

Knowledge and/or Skills

- Physical nature of noise
- Harmful effects of noise on people
- Noise measurement parameters
- Noise measurement instrumentation

Evidence Requirements

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

- explain the physical nature of noise in terms of the physics of its propagation through matter
- explain three potentially harmful effects of noise on people
- explain four different parameters which are important in the measurement of noise levels, to include instantaneous measurements and time-averaged measurements
- measure instantaneous noise levels in a specific situation

Assessment Guidelines

Assessment of the first three Evidence Requirements of Outcome 1 could be carried out via a closed-book assessment that provides the opportunity to cover the Knowledge and/or Skills detailed for the Outcome. An appropriate assessment could be a combination of short answer and restricted response questions. The final Evidence Requirement could be included as part of the assessment for Outcome 2. In addition, it would be possible to combine this assessment with that of Outcome 3, which may also be a closed-book assessment. In this case the recommended total time allowed might be in the order of 90 minutes.

Higher National Unit specification: statement of standards (cont)

Unit title: Noise and Radioactivity

Outcome 2

Evaluate techniques and strategies to control noise emissions in a specific situation, in the context of legislation

Knowledge and/or Skills

- Techniques and strategies to control noise emissions and limit reception
- Legislation relating to noise

Evidence Requirements

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

- formulate and justify by analysis a strategy to control noise in a specific situation where noise is a hazard or perceived to be a nuisance
- outline the main legislation relating to noise, and the application of that legislation in terms of the specific situation

Assessment Guidelines

It is recommended that this Outcome is assessed by means of a short assignment in which candidates measure noise levels in a specific situation where noise levels are a problem (this being the assessment of the final Evidence Requirement for Outcome 1), and then formulate a strategy to improve the situation. It is recommended that the candidate's evidence is in the form of a submission of about 750 words or equivalent plus diagrams as appropriate. It is recommended that candidates have access to course notes, textbooks, papers, reports and on-line resources during the preparation of their reports.

Higher National Unit specification: statement of standards (cont)

Unit title: Noise and Radioactivity

Outcome 3

Explain the production of and properties of radioactivity and its measurement

Knowledge and/or Skills

- Properties of alpha, beta and gamma radiation
- Origins of radioactivity
- Radioactivity — calculation of decay constant, exponential decay and activity
- Radioactivity measurement methods
- Radioactivity detection techniques

Evidence Requirements

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

- explain two properties of each of the three different types of radiation
- explain the origins of three natural sources of radioactivity and two artificial sources of radioactivity
- calculate one decay constant, two exponential decays and two activity calculations from given data
- explain one technique used to detect radiation and two techniques used to measure radioactivity

Assessment Guidelines

Assessment of Outcome 3 could be carried out via a closed-book assessment that provides the opportunity to cover the Knowledge and/or Skills detailed for the Outcome. An appropriate assessment could be a combination of structured and restricted response questions. It would be possible to combine this assessment with that for Outcome 1, and also with that for the first three evidence requirements of Outcome 4. In this case the recommended total time allowed might be in the order of 90 minutes (see Assessment Guidelines for Outcome 1).

Higher National Unit specification: statement of standards (cont)

Unit title: Noise and Radioactivity

Outcome 4

Explain the hazards, benefits and legislation associated with radioactivity

Knowledge and/or Skills

- Environmental hazards associated with radioactive materials
- Health hazards associated with radioactive materials
- Benefits of radioactivity
- Packaging and shielding required to transport radioactive materials
- Legislation relating to radioactive materials

Evidence Requirements

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

- explain the environmental hazards posed by radioactive materials
- explain the effects of alpha, beta and gamma radiation on human tissue at the molecular DNA level
- explain five different beneficial applications from using radioactive materials (to include only two from the medical health industry)
- explain the packaging and shielding required for the transportation of three different types of radioactive material
- explain the main legislation relating to the transport of two different types of radioactive material

Assessment Guidelines

The environmental/health issues attached to radioactivity could be assessed via a closed-book assessment. The assessment could be a combination of structured and restricted response answers, and could be combined with the assessment for Outcome 3. If this is integrated with the assessment of Outcome 1, then the total time allowed could be 90 minutes (see Assessment Guidelines for Outcome 1).

The transport and legislative evidence for the Outcome could be assessed by means of a small case study (or one selected from a number of alternative case studies), allowing the candidate to evaluate the technical problems and legislative regulations surrounding the movement of a radioactive source. A report of about 750 words or equivalent covering the case study may be appropriate as evidence for this part of the Outcome.

Administrative Information

Unit code: F6JK 35

Unit title: Noise and Radioactivity

Superclass category: PL

Original date of publication: May 2009

Version: 01

History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Noise and Radioactivity

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 an optional Unit within the HND in Environmental Management and Sustainability; but may also be offered on a freestanding basis where candidates have a basic knowledge and understanding of physics as well as confidence in mathematics.

Outcome 1 could be taught with emphasis on the basic physics of noise and how this is related to the effects of noise and its measurement. Candidates would be first introduced to the nature of sound waves and the important parameters of frequency and amplitude. The difficulties of having a workable scale for amplitude might lead to consideration of sound pressure levels and the implications of the decibel scale. This could follow into the effects of noise on humans, and, in particular, the potential of noise to damage the auditory mechanism and how this damage can be assessed. The cumulative effect of exposure to noise is also very important and this might be considered along with other difficulties of accurately measuring exposure to noise.

In Outcome 2 the candidates should acquire a familiarity with current relevant legislation as it is relevant to occupational noise and environmental noise — and how this relates to real situations. They will also consider real situations when covering techniques and strategy for the control and reduction of exposure to noise. A hierarchical approach is best for this, with the elimination or, at least, the minimisation of noise at source taking precedence over the downstream measures such as protected the listener. However in many situations Personal Protective Equipment (PPE) will be required, so the effectiveness of different types of ear protection will be discussed.

Outcome 3 allows the candidates to understand atomic theory sufficiently to know how instability is created in atoms, leading to radioactivity. The main types of radiation, such as alpha; beta; gamma; X-rays and neutrons, should be introduced along with their physical properties. Students should be able to calculate decay constants, radioactive half-life and activity. The origins of radioactive materials, such as nuclear fission and natural decay should be covered. A visit to a nuclear facility, such as a power station, would be beneficial in allowing students to see how industry produces, removes and treats radioactive waste. Detection devices, such as scintillation counters and Geiger Muller tubes, should be described.

In Outcome 4, the candidates will acquire an understanding of the effect of different radiation types on human tissue. Methods by which radioactive atoms may enter water supplies and the human food chain should be discussed. The candidates should acquire a good knowledge of legislation on the movement, shielding, storage and transport of radioactive materials.

Higher National Unit specification: support notes (cont)

Unit title: Noise and Radioactivity

Guidance on the delivery and assessment of this Unit

Ideally this Unit should be delivered using a variety of methods and media, such as lectures, tutorials and problem solving exercises. Appropriate site visits may help illustrate concepts and the application management strategies, such as to a nuclear power station or an industrial facility where noise control or management is an issue.

The Unit deals with two different subject areas, and therefore divides neatly into two halves. Logically each half should be assessed separately. Alternatively it would be possible for most of Outcomes 1 and 3, and part of Outcome 4 to be assessed together by means of a single closed-book test with an allowed time of 90 minutes. The final Evidence Requirement of Outcome 1, all of Outcome 2 and the final two Evidence Requirements of Outcome 4 could to be assessed by two short individual reports covering two separate case studies.

Opportunities for developing Core Skills

There are opportunities for the candidate to develop the Writing component of the Core Skill *Communication* at SCQF level 6 in the assessment of all Outcomes. If candidates complete written work for each Outcome they will have an opportunity to develop the general skill, 'produce well structured written communication on complex topics'. When completing their responses to Outcomes, candidates will have to present essential ideas/information and supporting detail in a logical and effective order. Outcome 3 requires the calculation of radioactive half-life and related parameters, so there is the opportunity here to develop the Using Numbers component of the Core Skill *Numeracy*, also to SCQF level 6. Outcome 2 will involve the Reviewing and Evaluating component of the Core Skill *Problem Solving* at SCQF level 6.

Open learning

Many of the elements of this Unit could be delivered on an open (distance) learning basis. Where evidence requires to be generated in a closed-book, supervised manner, the delivering centre should ensure that measures have been put in place to assure the authenticity of the candidate's submission.

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

General information for candidates

Unit title: Noise and Radioactivity

Noise and radioactivity are a part of the natural environment, but human activities have increased the incidence of both. It is therefore important from an environmental impact and a workplace management viewpoint that both radioactivity and noise are understood and measurable, and that management strategies are in place.

An initial overview of noise will develop an understanding of what noise actually is, focusing on the propagation of noise through pressure waves. Different methods of measuring noise will be explained, using appropriate Units and contrasting instantaneous versus time averaged methods. Appropriate case-study situations will be used to illustrate these principles and the use of measurement techniques. Based on the basics of noise, you will then go on to consider the management of noise in environmental and workplace situations. The appropriateness of different techniques will be examined for different situations, giving you an ability to match technique to situation. This will be done within the context of current legislation relevant to noise, and you will become familiar with the important aspects of this legislation.

The study of radioactivity starts with developing an understanding of the structure and nature of the atomic nucleus, contrasting stable versus unstable nuclei. This leads to understanding the origins of the different radioactive materials, and to the measurement of these different types of radioactivity using different devices. An important concept in understanding and predicting the effects of radioactivity is that of half-life, which allows calculation of how radioactive activity changes with time. The effects radiation has on living tissue are explained, along with those situations (such as radioisotope dating and radiography) where radioactivity can be used advantageously. The relevance of legislation relating to radioactive substances is emphasised, and you will gain an understanding of how the legislation relates to the movement, shielding, storage and transport of substances such as radioactive waste.

Assessment of the Unit will normally be by closed-book test, and by two separate small assignments requiring short reports to be written. You will be asked to explain complex ideas and principles related to noise and radioactivity. This will offer opportunities to develop the Core Skill of *Communication* (Writing or Oral). Calculation of parameters connected to radioactive decay is required, giving opportunities to develop the Core Skill of *Numeracy* (Using Numbers), and the Core Skill of *Problem Solving* (Reviewing and Evaluating) will be developed when evaluating appropriate noise control strategies.