Higher National Unit Specification

General information for centres

Unit title: Radiation Physics: Foundations

Unit code: DW9A 34

Unit purpose: This Unit provides an introduction to the physics underlying the safe production and use of ionising radiations and explains the legislation governing safe practice in the medical uses of these radiations.

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

1 Describe the structure and behaviour of the atom in its stable and unstable states and the characteristics of ionising and non-ionising radiations.
2 Describe the physical principles of X-ray production and the basic technology required for X-ray generation.
3 Explain the radiographic significance of the interaction of radiation with living and non-living materials.
4 Describe the principles of radiation protection and the radiation safety requirements in radiotherapy/radiology departments.

Credit points and level: 1 HN 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 Access 1 to Doctorates.*

Recommended prior knowledge and skills: None. Access to this Unit is at the discretion of the centre.

Core Skills: There are opportunities to develop the Core Skills of Problem Solving and Numeracy at level 5 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. This Unit is mandatory in the frameworks for HNC Allied Health Professions: Diagnostic Imaging and HNC Allied Health Professions: Radiotherapy.

Assessment: This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

Higher National Unit specification: statement of standards

Unit title: Radiation Physics: Foundations

Unit code: DW9A 34

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

Describe the structure and behaviour of the atom in its stable and unstable states and the characteristics of ionising and non-ionising radiations

Knowledge and/or skills

- Terminology and Units of measurement commonly used in radiation physics
- Structure of the atom in its stable and unstable form
- Basic principles of radioactivity and radioactive decay
- Energy and Energy Transfer
- The electromagnetic spectrum
- Characteristics of non-ionising radiations
- Characteristics of ionising radiations

Evidence Requirements

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

- describe the structure and behaviours of an atom in its stable state
- describe how this differs from it excited unstable state
- relate this to radioactivity and radioactive decay

Candidates must also be able to demonstrate their knowledge of the characteristics of:

- the ionising contained within the electromagnetic spectrum and
- non-ionising radiations contained within the electromagnetic spectrum

Assessment guidelines

This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

Higher National Unit specification: statement of standards (cont)

Unit title: Radiation Physics: Foundations

Outcome 2

Describe the physical principles of X-ray production and the basic technology required for X-ray generation

Knowledge and/or skills

- Basic structure and components of an X-ray tube
- Bremsstrahlung and characteristic radiation
- Processes involved in X-ray production

Evidence Requirements

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

- describe the structure and function of an x-ray tube
- explain the physical principles that underpin x-ray generation for medical use

Assessment guidelines

This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

Outcome 3

Explain the radiographic significance of the interaction of radiation with living and non-living materials

Knowledge and/or skills

- Principles of radiation attenuation and absorption
- Photo electric, Compton and pair production interactions
- Relationship of radiation energy to interaction type
- Radiobiological effects of ionising radiation interaction with human tissue
- Stochastic and deterministic effects of radiation
- Radiation interaction with non-living materials

Evidence Requirements

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

- explain the physical principles and biological Outcomes of radiation interaction with living and non-living materials

Assessment guidelines

This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

Higher National Unit specification: statement of standards (cont)

Unit title: Radiation Physics: Foundations

Outcome 4

Describe the principles of radiation protection and the radiation safety requirements in radiotherapy/radiology departments

Knowledge and/or skills

- Principles of radiation protection
- The inverse square law
- ALARA principles
- Mechanical, electrical and radiation safety features of x-ray equipment
- Legislation governing the use of radiation in medicine
- Use of 'local rules' within a radiology or radiotherapy department
- Personnel monitoring
- Mechanisms used to safeguard self and others within a radiology or radiotherapy department

Evidence Requirements

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

- apply legislation, reference/guidance materials and local procedures to ensure safe working within a radiation environment

Assessment guidelines

This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

Administrative Information

Unit code: DW9A 34

Unit title: Radiation Physics: Foundations

Superclass category: RC

Original date of publication: September 2006

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: Radiation Physics: Foundations

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

It is expected that the delivery of this Unit will make on-going reference to the candidates' clinical experiences. Relevant practical laboratory work should be included. Reference should be made to current 'Local Protocols' and personnel monitoring procedures.

Useful information to help with this Unit can be found at the following websites:

www.sor.org (Society and College of Radiographers)

www.BIR.ac.uk (British Institute of Radiology)

Outcome 1

The candidate will understand radiation physics terminology and Units of measurement commonly used a health context. This should include atomic structure and the basic principles of radioactive decay and related energy transfers. Candidates should be familiar with the range of the electromagnetic spectrum and the applications of various wavelengths and with the basic characteristics of ionising and non-ionising radiations

Outcome 2

Candidate should have a sufficient knowledge of the structure and components of an X-ray tube and of the processes involved in x-ray production to enable them to understand relevant workplace procedures including health and safety.

Outcome 3

Candidates should be familiar with the effects of the interaction of radiation with living and non-living materials (including stochastic and deterministic effects). They should be aware of the effect on that interaction of energy, time, distance and shielding, and of attenuation and absorption.

Outcome 4

Candidates should be familiar with the principles of radiation protection, the safety features of equipment used, and the inverse square laws principle. They should know the legislation governing the use of radiation in the workplace generally and specifically in a health context. They should know the reasoning behind the 'local rules' (IR(ME)R) used in the workplace including the ALARA principle. Mechanisms used to safeguard self and others within a radiology or radiotherapy department including personnel monitoring should be discussed. Candidates should understand the implications of diagnostic reference levels (DRLs) used in digital radiography.

Higher National Unit specification: support notes (cont)

Unit title: Radiation Physics: Foundations

Guidance on the delivery and assessment of this Unit

This Unit could be assessed through several short closed-book assessments comprising short descriptive answer style questions and multiple-choice questions.

The Unit could be assessed Outcome by Outcome or in different groupings if this better suits the delivery method.

The Unit will be delivered as a series of interactive lectures, seminars and practical workshops.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Problem Solving and Numeracy at level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality Assurance and Distance Learning* (SQA 2000).

Candidates with additional support needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on SQA's website: **www.sqa.org.uk**.

General information for candidates

Unit title: Radiation Physics: Foundations

This Unit will provide you with knowledge of physics relevant to its application in a Radiography environment. The Unit begins by introducing the basic features of the stable atom and from this the principles of radioactivity and radioactive decay.

Energy and energy transfer will introduce study of the electromagnetic spectrum and the characteristics and behaviours of ionising and non-ionising radiations.

Production of x- rays and the equipment required to produce x-rays will be studied as well as the mechanisms and effects of X-ray interaction with living tissue.

The content of this Unit has been designed to allow you to understand the relevance of theory in practice and a key feature of this is to provide you with sufficient knowledge to work safely within a radiation environment. You will study personnel monitoring in a radiography department, radiation safety processes to protect operators and public and the legislation that governs the use of medical radiations.

You will find useful information to help you with this Unit at the following websites:

www.sor.org (Society and College of Radiographers)

www.BIR.ac.uk (British Institute of Radiology)

Ball, J. and Moore, A. D. 1997. *Essential Physics for Radiographers*.
3rd ed. Oxford: Blackwell Science

Ball, J. and Price, T. 1995. *Chesney's Radiographic Imaging*.
6th ed. Oxford: Balckwell Science.

Graham, D. T. and Cloke, P. 2003. *Principles of Radiological Physics*.
4th ed. Edinburgh: Churchill Livingstone