

Unit 106: Scientific Basis of Medical Physics

Level: 4

Unit type: Optional (Equipment Management and Clinical Engineering)

Credit value: 30

Guided learning hours: 240

Unit summary

In this unit, you will gain the understanding of the breadth of the application of science within medical physics technology, the underpinning radiation physics and you will be able to work safely within the medical physics environment in a hospital. You will be expected to apply and contextualise your knowledge and skills by performing routine technical skills and developing and building your professional practice in accordance with Good Scientific Practice.

Unit assessment requirements

There are no specific assessment requirements for this unit. Please refer to the assessment strategy in *Annexe B*.

Additional information

AC1.1 includes:

- the basic laws that underpin electricity and magnetism
- sources of radiation and their physical properties
- physical properties of radiation.

AC1.2 includes:

- interactions of radiation with matter
- radiation quality – half-value layer (HVL) and tenth-value layer (TVL), quality index
- attenuation, absorption and scatter (photo-electric, Compton scatter and pair production)
- exponential attenuation of monoenergetic photons
- electron scattering and bremsstrahlung
- ionisation and excitation
- electron range and energy
- inverse square law
- filters and filtration

- effects of electron and photon energy, absorber density and atomic number tissue equivalent materials.

AC1.3 includes:

- basic ionising radiation protection
- international and national legislation, guidance, standards and recommendations
- hospital organisation of radiological protection: radiation safety policy, local rules
- designation of areas
- classification of persons
- roles and responsibilities of staff, including duty holders
- as low as reasonably practicable (ALARP)
- basic principles of dose limitation: time, distance, shielding
- radiation protection of public and staff
- radiation protection of individuals
- transportation of radioactive materials
- administration of radionuclides
- high-activity materials
- disposal of radioactive materials
- personnel and environmental dose monitoring.

Learning outcome 2 includes:

- the sources of radiation and their physical properties
- the physical properties of radiation
- atomic structure and radioactive decay
- atomic and nuclear structure, mass number, atomic number, isotopes
- mechanisms of radioactive decay
- alpha, beta and gamma radiation
- half-life, mean life, physical half-life
- decay schemes and energy level diagrams
- the units of activity
- specific activity, radioactive concentration.

AC2.1 includes:

- the types of radiation
- the basic equipment and clinical applications of each type of radiation, to include diagnosis and therapy
- introduction to ionising radiation equipment in medical physics
- radiation detectors
- gamma camera and single-photon emission computed tomography (SPECT)

- basic diagnostic x-ray equipment
- computed tomography (CT)
- SPECT-CT
- positron emission tomography (PET) and PET/CT
- accelerator
- orthovoltage (kV) radiotherapy unit
- radiotherapy treatment planning system (TPS)
- brachytherapy after-loaders
- cyclotron
- production of x-rays
- general principles
- electromagnetic spectrum
- production of x-rays (low to megavoltage)
- x-ray tubes
- linear accelerators.

AC4.1 includes:

- diagnostics
- therapeutics
- the equipment life cycle
- innovation and service development.

AC4.2 includes the role of a medical physics healthcare science associate in radiotherapy:

- mould room
- treatment planning
- quality assurance
- quality control

the role of a medical physics healthcare science associate in nuclear medicine:

- radiopharmacy
- scanning
- radionuclide therapy

the role of a medical physics healthcare science associate in radiation protection:

- room surveys
- quality assurance
- quality control
- environmental monitoring
- personnel monitoring
- sealed sources

- unsealed sources.

AC4.3 includes:

- the patient pathway and within the wider context of healthcare.

Learning outcomes and assessment criteria

To pass this unit, learners need to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria outline the requirements that the learner is expected to meet **in own area of work and in accordance with Standard Operating Procedures (SOPs)** to achieve the learning outcomes and the unit.

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
1	Understand core principles of medical physics	1.1	Explain, using the correct scientific terminology, the core principles of medical physics			
		1.2	Explain the interactions of radiation with matter			
		1.3	Evaluate the principles of radiation protection in a medical physics setting			
2	Understand the biological effects and measurement of radiation	2.1	Explain the basic equipment to generate radiation and the clinical applications of radiation			
		2.2	Explain the biological effects of each type of radiation			
		2.3	Explain how each type of radiation is measured			
		2.4	Explain the possible health effects of each type of radiation			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
3	Understand the procedures and need for evaluation of adverse incidents	3.1	Explain the procedure for identifying and reporting adverse incidents			
		3.2	Discuss the need for reporting and evaluation of adverse incidents			
		3.3	Discuss the potential impact of adverse incidents on patients, carers, and healthcare professionals			
4	Understand the key roles of a healthcare science associate in medical physics	4.1	Explain the key roles of medical physics services			
		4.2	Explain the key role of a healthcare science associate in medical physics			
		4.3	Evaluate the impact of medical physics services on patients and the patient care pathway			

Learner name: _____

Date: _____

Learner signature: _____

Date: _____

Assessor signature: _____

Date: _____

Internal verifier signature: _____

Date: _____

(if sampled)