

Scheme of work: ASC 6b Medical Physics

The following scheme of work offers a route through the Applied General Science Unit 6B Medical Physics, covering all the sections in a logical order. The order is by no means prescriptive and there are many alternative ways in which the content could be organised.

Assumed coverage

This scheme of work is a plan of what will be covered in each week or session of the learning programme or course. It will detail over 30 weeks the delivery of the applied science course content for the examination. The scheme of work will also give resources and ideas for practical work that can illustrate the written content.

PO1 Understand imaging methods

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| **Specification content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO1:**  Understand imaging methods. | P1:  Describe the underlying theory behind two of the imaging methods listed. | Tutor observation of discussion.  Oral communication during discussion.  Research. | 1 | Tutor led discussion on the different types of imaging methods listed. Emphasise the difference between imaging and therapy. Look at the history, recent developments and equipment required.  Individual learner led research on [choice of imaging method.](https://www.nlm.nih.gov/medlineplus/diagnosticimaging.html)  Learners can be shown actual images from X-rays, MRI scans etc.  [Diagnostic imaging](https://www.nlm.nih.gov/medlineplus/diagnosticimaging.html) |
| **PO1:**  Understand imaging methods. | P1:  Describe the underlying theory behind two of the imaging methods listed.  M1:  Link the underlying theory behind both of the imaging methods to explain how the images are produced. | Tutor observation of plenary.  Written evidence (P1, M1).  Oral communication during discussion.  Spelling and scientific nomenclature for report.  Research. | 2 | Tutor led link to previous week.  Learners led activity to write a report on findings, make sure scientific language is used.  Learners to give a plenary (discussion/PowerPoint) on the research they have carried out.  Those learners doing **M1** to include underlying theory of the image production for each method.  Learner working independently.  [X-ray imaging](http://www.iop.org/education/teacher/resources/teaching-medical-physics/xray/page_56315.html) |
| **PO1:**  Understand imaging methods. | P2:  Select one medical condition and identify a suitable and an unsuitable technique for investigating the condition. | Tutor observation of discussion and answers to questions.  Written evidence (P2).  Oral communication during discussion.  Spelling and scientific nomenclature for report.  Research skills. | 3 | Tutor led discussion on different medical conditions that can be imaged using the imaging methods listed. Discuss suitability; would you use MRI to diagnose a broken leg?  Learner led research and write up for **P2.**  Learner working independently.  [Why is medical imaging important?](http://www.medicalradiation.com/types-of-medical-imaging/imaging-using-x-rays/) |
| **PO1:**  Understand imaging methods. | P2:  Select one medical condition and identify a suitable and an unsuitable technique for investigating the condition.  M2:  Explain why the selected technique is suitable and the unsuitable technique is not appropriate. | Written evidence (P2, M2).  Spelling and scientific nomenclature for report. | 4 | Learner led work from previous week (**P2**), continuing with an explanation for suitability and unsuitability for different techniques (**M2**).  [Types of scan](https://www.alliancemedical.co.uk/what-we-do/patient-services/types-of-scan)  [X-ray diagnosis and therapy](http://www.sciencemuseum.org.uk/broughttolife/techniques/xrays.aspx)  Learners working independently. |
| **PO1:**  Understand imaging methods. | D1:  For both methods, use calculations to support descriptions of the underlying theory. | Tutor observation of learner research.  Written evidence (P1, P2, M1, M2, D1).  Tutor to check accuracy of calculations.  Calculations.  Research.  Spelling and scientific nomenclature for report. | 5 | Learner led completion of PO1.  Learners attempting D1 to check calculations with tutor. Ensure the calculations are for diagnosis and not therapy.  Calculations for D1 sourced with no help from tutor. |
| **PO1:**  Understand imaging methods. | P1:  Describe the underlying theory behind two of the imaging methods listed.  M1:  Link the underlying theory behind both of the imaging methods to explain how the images are produced.  P2:  Select one medical condition and identify a suitable and an unsuitable technique for investigating the condition.  M2:  Explain why the selected technique is suitable and the unsuitable technique is not appropriate.  D1:  For both methods, use calculations to support descriptions of the underlying theory. | Written work (P1, P2, M1, M2, D1).  Calculations.  Spelling, grammar and scientific nomenclature for report. | 6 | Learner led workshop session to complete written work for PO1.  Working independently to produce accurate work.  Work handed in on time. |

PO2 Understand radiotherapy techniques and the use of radioactive tracers

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| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P3:  Describe, with the aid of diagrams, two radiotherapy techniques, including the disease or disorder linked with each. | Tutor observation of discussion.  Tutor observation of research.  Written evidence (P3).  Spelling and scientific nomenclature.  Research skills. | 7 | Tutor led introduction to radiotherapy techniques; early therapy machines, breast brachytherapy, linear accelerator and intensity modulated radiation therapy (IMRT). Include disorder/disease related to each technique.  Learner led research and written report, use scientific language (P3).  Independent research, with no help from the tutor.  [Novel Radionuclide therapies](http://www.snm.org/docs/mwm13/Presentations/Thursday/Novel%20Radionuclide%20Therapies%20-%20Erik%20Mittra.pdf) |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P3:  Describe, with the aid of diagrams, two radiotherapy techniques, including the disease or disorder linked with each.  M3:  Explain how each technique is used to treat specific diseases. | Written evidence (P3, M3).  Spelling and scientific nomenclature. | 8 | Learner led report from previous week (P3), explanation of how each technique is used including equipment used.  [Radioisotopes in medicine](http://www.world-nuclear.org/info/Non-Power-Nuclear-Applications/Radioisotopes/Radioisotopes-in-Medicine/)  Learners work independently. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | D2:  Discuss the invasive nature of the techniques on patients. | Tutor observation of research methods.  Written evidence (P3, M3, D2).  Spelling and scientific nomenclature.  Research skills. | 9 | Learner led research into the possible side effects of radiotherapy, eg hair loss, fatigue and sickness.  This depends on the dosage and the part of the body being treated.  [Possible side effects of radiotherapy](http://www.macmillan.org.uk/information-and-support/treating/radiotherapy/radiotherapy-explained/possible-side-effects.html)  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P4:  Identify the properties of one radioisotope used for a radiotherapy technique. | Tutor observation of research methods.  Written evidence (P4).  Spelling and scientific nomenclature.  Research skills. | 10 | Tutor led introduction to the structure, manufacture and effects of radioisotopes.  [Radioisotopes in medicine](http://www.world-nuclear.org/information-library/non-power-nuclear-applications/radioisotopes-research/radioisotopes-in-medicine.aspx)  Learners select and identify the properties of one radioisotope that is used for radiotherapy.  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P4:  Identify the properties of one radioisotope used for a radiotherapy technique.  M4:  Explain the importance of these properties. | Written evidence (P4, M4).  Spelling and scientific nomenclature. | 11 | Those learners attempting M4 need to explain the importance of these properties to the relevant therapy.  [Current role of modern radiotherapy techniques in the management of breast cancer](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4127613/)  Learners work independently and work is handed in on time. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | D3:  Provide quantitative support for the explanations. | Tutor observation of calculations.  Written evidence (P4, M4, D3).  Spelling and scientific nomenclature.  Research skills.  Calculations. | 12 | Learner led research into decay, emission reactions and half-life calculations for radioisotopes.  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P5:  Outline how radioisotopes can be used as tracers. | Tutor observation of research.  Written evidence (P5).  Spelling and scientific nomenclature.  Research skills. | 13 | Tutor led introduction of the use of radioisotopes as tracers, to identify abnormalities, in medicine.  [Using isotopes as tracers](http://sciencelearn.org.nz/Contexts/Just-Elemental/Looking-Closer/Using-isotopes-as-tracers)  Learner led research into how radioisotopes are used as tracers; including how they are produced, biological behaviour that determines how it is used.  [Radioactivity](http://www.gcsescience.com/prad28-radioactive-tracer-medicine-blood.htm)  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | M5:  Describe the properties of two radioisotopes that make them suitable for use as tracers. | Tutor observation of research.  Written evidence (P5, M5).  Spelling and scientific nomenclature.  Research skills. | 14 | Learner led research comparing the properties of two different radioisotopes.  [Radioisotope properties](https://www.promega.co.uk/~/media/files/resources/technical%20references/radioisotope%20properties.pdf)  Look at localisation and why some radioisotopes are effective for certain parts of the body.  [Medical isotopes](http://www.radiochemistry.org/nuclearmedicine/radioisotopes/01_isotopes.shtml)  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | D4:  Source and evaluate quantitative/graphical data of the two radioactive tracers. | Tutor observation of research and graphs.  Written evidence and calculations (P5, M5, D4).  Spelling and scientific nomenclature.  Research skills.  Formulas and calculations. | 15 | Learner led research into [physical and biological half lives](http://hyperphysics.phy-astr.gsu.edu/hbase/nuclear/technetium.html) of two radioactive tracers including formulas and graphs.  Independent research, with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P6:  Describe the dangers of radioactivity and the precautions taken to protect medical staff and patients. | Tutor observation of discussion.  Tutor observation of research and PowerPoint.  Written evidence (P6).  Oral communication during discussion.  Spelling and scientific nomenclature for PowerPoint.  Research. | 16 | Tutor led discussion on the dangers of radioactivity and on the precautions taken to protect medical staff and patients. Look at the different ways that radioactivity is used in medicine and the various practitioners that use and prepare the doses.  Learners to research and produce a PowerPoint that covers the key learning objective.  A visit to a hospital or medical unit would be helpful.  [Radiation protection advice](https://www.uhb.nhs.uk/rrpps-radiation-protection-advice.htm)  Learners work without help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | M6:  Explain the scientific principles behind the precautions. | Written evidence (P6, M6).  Spelling, grammar and scientific nomenclature for report. | 17 | Learner led activity to complete PowerPoint from previous week (P6) and give explanations (M6).  [Radiation safety](http://www.e-lfh.org.uk/programmes/radiation-safety/)  Work completed on time with no help from the tutor. |
| **PO2:**  Understand radiotherapy techniques and the use of radioactive tracers. | P3:  Describe, with the aid of diagrams, two radiotherapy techniques, including the disease or disorder linked with each.  M3:  Explain how each technique is used to treat specific diseases.  D2:  Discuss the invasive nature of the techniques on patients.  P4:  Identify the properties of one radioisotope used for a radiotherapy technique.  M4:  Explain the importance of these properties.  D3:  Provide quantitative support for the explanations.  P5:  Outline how radioisotopes can be used as tracers.  M5**:**  Describe the properties of two radioisotopes that make them suitable for use as tracers.  D4:  Source and evaluate quantitative/graphical data of the two radioactive tracers.  P6:  Describe the dangers of radioactivity and the precautions taken to protect medical staff and patients.  M6:  Explain the scientific principles behind the precautions. | Written work (P3, P4, P5, P6, M3, M4, M5, M6, D2, D3, D4).  Spelling and scientific nomenclature for written portfolio work.  Formulas and calculations. | 18 | Learner led workshop session to complete written work for PO2.  Working independently to produce accurate work.  Work handed in on time. |

PO3 Demonstrate the ability to work with radioisotopes in the laboratory

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| **PO3:**  Demonstrate the ability to work with radioisotopes in the laboratory. | P7:  Follow standard procedures to measure the half-life of one radioisotope. | Tutor observation of practical work, graph and the risk assessment.  Graph and maths involved.  Health and safety during experiment. | 19 | Tutor led introduction to radioisotopes, working with them and the risks involved.  The experiment can be carried out as a demonstration to show the half-life of protactinium. Learners are to complete a risk assessment and to draw a graph showing decay with time.  [Measuring the half-life of protactinium](http://practicalphysics.org/measuring-half-life-protactinium.html)  [Equipment can be obtained from Philip Harris](https://www.philipharris.co.uk/product/physics/atomic-physics/radiation/experimental-radioactivity-set/b8h27143) |
| **PO3:**  Demonstrate the ability to work with radioisotopes in the laboratory. | P7:  Follow standard procedures to measure the half-life of one radioisotope. | Tutor observation of  practical work, graph and  the risk assessment.  Graph and maths involved.  Health and safety during experiment. | 20 | Learner led practical work using procedure and risk assessment from previous week.  Geiger counters can be used to find background levels and used on different types of rocks.  [Radioactivity in the classroom](http://www.scienceinschool.org/2009/issue12/radioactivity)  Complete practical work and risk assessment with no tutor help. |
| **PO3:**  Demonstrate the ability to work with radioisotopes in the laboratory. | P7:  Follow standard procedures to measure the half-life of one radioisotope.  M7:  Relate the results of the experiments to the use of radioisotopes in medical treatments. | Written work (**P7, M7).**  Spellings and grammar used in report.  Research skills. | 21 | Understanding of half-life can be reinforced with a video.  [Decay of half the atoms in a sample or half-life](http://www.bbc.co.uk/education/clips/z8qqxnb)  Learner led activity to write a report on the procedure to measure half-life (**P7**). Included in the report is the risk assessment and information for (**M7**) which relates the results to the use of radioisotopes for medical treatment.  Independent working |
| **PO3:**  Demonstrate the ability to work with radioisotopes in the laboratory. | D5:  Summarise the advantages and disadvantages of alpha, beta and gamma radioisotopes in medical treatments. | Written work **(P7, M7, D5).**  Spellings and grammar used in report.  Research skills. | 22 | Learner led activity to complete report for **PO3**.  For **D5** learners will research the properties of [alpha, beta and gamma emissions from radioisotopes.](http://www.docbrown.info/page03/3_54radio04.htm)  Learners to analyse these [properties of radiation](http://www.physics.isu.edu/radinf/properties.htm) to work out advantages and disadvantages for use in medical treatments.  Independent working. |

**PO4 Understand the medical uses of optical fibres and lasers**

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| **Specification content** | **Learning objectives** | **Additional guidance** | **Session number** | **Learning activities and resources** |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | P8:  Describe the structure of optical fibres and how they transmit light. | Tutor observation of discussion.  Tutor observation of practical work and risk assessment.  Oral communication during discussion.  Practical skills and health and safety.  Calculation of total internal reflection. | 23 | Tutor led discussion about [optical fibres](http://www.explainthatstuff.com/fiberoptics.html): transmission (total internal reflection) and image formation.  Experiment to show [total internal reflection.](https://www.education.com/science-fair/article/wire-fiber-optic-network-total/)  Learners work independently. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | M8:  Explain how optical fibres are used in medical treatments. | Written work **(P8, M8).**  Tutor observation of written and research skills.  Spellings and grammar used in report.  Research skills. | 24 | Learner led activity to write information from previous week for **P8** and to research into the [medical use of optical fibres.](http://www.genesis.net.au/~ajs/projects/medical_physics/endoscopes/)  Look at different medical uses for the endoscope and what makes up its components.    Learners work independently. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | P9:  Follow standard procedure to measure the refractive index of a sample of glass or Perspex. | Tutor observation of practical work and adherence to risk assessment.  Calculation of refractive index.  Practical skills and health and safety. | 25 | Tutor led introduction to refractive index and the experimental procedure, including risk assessment.  Learner led practical work to [measure the refractive index](https://tap.iop.org/vibration/reflection/317/file_46715.doc) of glass (could also experiment using different types and shapes of glass).  Comparison of results.  Independent practical work. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | P9:  Follow standard procedure to measure the refractive index of a sample of glass or Perspex. | Tutor observation of practical work and adherence to risk assessment.  Written work (**P9**).  Calculations for refractive index.  Spellings and grammar used in report.  Ability to work unsupervised.  Practical skills and health and safety. | 26 | Tutor led introduction to experiment from the previous week. Experiment from previous week repeated using Perspex.  Learner led practical work to find the [refractive index of Perspex](https://tap.iop.org/vibration/reflection/317/file_46715.doc) (could also experiment using different shapes and types of plastic).  Comparison of results.  Learners to write up an experimental report.  Independent practical/written work. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | P10:  Identify two medical conditions where laser bight is used as a treatment. | Written work (**P10**).  Spellings and grammar used in written work. | 27 | Tutor led introduction into [laser light therapy](http://www.healthline.com/health/laser-therapy). What it is used for, how it is done and the risks involved.  [Cold laser therapy pain management treatment](http://www.spine-health.com/treatment/pain-management/cold-laser-therapy-pain-management-treatment)  Learner led research and written work for **P10**. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | M9:  Explain the basic scientific principles behind the use of lasers in treating both medical conditions. | Written work (P10, M9).  Spellings and grammar used in written work. | 28 | Tutor led review of work from previous week; and outline of basic scientific principles of laser treatment. Learner led task to explain principles related to the two conditions that they have picked for P10.  [Photobiomodulation](http://www.aslms.org/for-the-public/treatments-using-lasers-and-energy-based-devices/photobiomodulation)  [How does low level laser therapy work?](http://createyourwellness.com/additional-services/low-level-laser-therapy/how-does-low-level-laser-therapy-work-.html)  Independent work. |
| **PO4:**  Understand the medical uses of optical fibres and lasers. | D6:  Compare the advantages and disadvantages of laser and non-laser treatments for a specific medical condition. | Written work (D6).  Spellings and grammar used in written work. | 29 | Learner led task to carefully choose a medical condition that can be treated by laser and by another type of therapy. The treatments are then compared using advantages and disadvantages.  [Laser therapy advantages and disadvantages](http://torkelsonchiro.com/laser-therapy/laser-advantages-and-disadvantages.html)  [LASIK laser eye surgery](http://www.webmd.boots.com/eye-health/guide/lasik-laser-eye-surgery) |
| **PO3:**  Demonstrate the ability to work with radioisotopes in the laboratory.  **PO4:**  Understand the medical uses of optical fibres and lasers. | P7:  Follow standard procedures to measure the half-life of one radioisotope.  M7:  Relate the results of the experiments to the use of radioisotopes in medical treatments.  D5:  Summarise the advantages and disadvantages of alpha, beta and gamma radioisotopes in medical treatments.  P8:  Describe the structure of optical fibres and how they transmit light.  M8:  Explain how optical fibres are used in medical treatments.  P9:  Follow standard procedure to measure the refractive index of a sample of glass or Perspex.  P10:  Identify two medical conditions where laser bight is used as a treatment.  M9:  Explain the basic scientific principles behind the use of lasers in treating both medical conditions.  **D6**:  Compare the advantages and disadvantages of laser and non-laser treatments for a specific medical condition. | Written work (P7, P8, P9, P10, M7, M8, M9, D5, D6).  Spelling, grammar and scientific nomenclature for report. | 30 | Learner led workshop session to complete written work for PO3 and PO4.  Working independently to produce accurate work.  Work handed in on time. |