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| Senior Chemistry/Year 11 Chemistry Videoconference |
| Outline and syllabus outcomes |
| ANSTO is a leader in chemical, materials and environmental research, and produces many of Australia’s medical radiopharmaceuticals.ANSTO conducts Chemistry videoconferences, which cover specific Knowledge and Understanding content from the Australian Senior Secondary Curriculum **Unit 1: Chemical fundamentals: structure, properties and reactions**, specifically the section Properties and structure of atoms - RadioisotopesScience Inquiry Skills and Science as a Human Endeavour content descriptions are also addressed. ANSTO videoconference outlineThe videoconference outlined on the following pages is for an **80 minute lesson**, however, it **can be adjusted to suit shorter or longer lesson times.**A **videoconference workbook** which complements what is presented has also been developed for students to complete during the videoconference. The workbook also includes pre- and post- videoconference activities.Students will: * Investigate the properties of the types of radiation (alpha, beta and gamma)
* Observe background radiation in our cloud chamber
* Collect data during a demonstration of a radiation experiment, using low level radioactive sources and radiation detection equipment.
* Understand the operation and uses of OPAL (Open Pool Australian Lightwater) Research Reactor
* Understand that radioisotopes have a wide variety of uses, including in nuclear medicine, radiotherapy and in dating in geology and palaeobiology
* Understand the production and use of radioisotopes used in nuclear medicine, including Technetium-99m
* Understand the use of ANSTO’s tandem particle accelerators in relation to dating and the environment
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**Links to the Australian Senior Secondary Curriculum – Chemistry**

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| **Videoconference content** | **Curriculum links** |
| **Radiation Investigation*** Why some atoms are radioactive – discussion of neutron to proton graph

 * Demonstration of the properties of alpha, beta and gamma (penetration through paper, aluminium, lead) using alpha, beta and gamma radioactive sources and scintillation counter.

**Detectors of radiation*** How a cloud chamber detects radiation
* Students draw traces left by alpha particles, beta particles and muons in the cloud chamber
* Monitoring radiation levels in the workplace
 | **Science Understanding**Isotopes are atoms of an element with the same number of protons but different numbers of neutrons; different isotopes of elements are represented using atomic symbols (for example, $\begin{matrix}12\\6\end{matrix}C$ , $\begin{matrix}13\\6\end{matrix}C$ (ACSCH021)**Science Inquiry Skills**Identify, research and refine questions for investigation; propose hypotheses; and predict possible outcomes (ACSCH001)Represent data in meaningful and useful ways, including using appropriate graphic representations and correct units and symbols; organise and process data to identify trends, patterns and relationships; identify sources of random and systematic error and estimate their effect on measurement results; and select, synthesise and use evidence to make and justify conclusions (ACSCH004) |
| **OPAL*** Virtual tour of the OPAL research reactor to discuss the reactor components and their function, and the operation of OPAL
	+ Animation model of the process of nuclear fission
	+ The purpose of OPAL reactor to produce nuclear medicines, irradiate silicon and produce neutrons for research
 | **Science as a Human Endeavour**Development of complex models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines (ACSCH010)Advances in science understanding in one field can influence other areas of science, technology and engineering (ACSCH011)The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences (ACSCH013) |

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| **Videoconference content** | **Curriculum links** |
| **Radioisotopes for use in nuclear medicine*** Production of nuclear medicine in OPAL
* Molybdenum processing at ANM (show ANM manufacture presentation 2019)
* explain how Gentech generator works
* use of Tc-99m as a diagnostic radionuclide
* Use of some other reactor produced radionuclides – Lu-177, Iodine-131 as examples of therapeutic radionuclides
 | **Science Understanding**Isotopes of an element have the same electron configuration and possess similar chemical properties but have different physical properties, including variations in nuclear stability (ACSCH022)**Science as a Human Endeavour (examples in context)***Radioisotopes have a wide variety of uses, including Carbon-14 for carbon dating in geology and palaeobiology; radioactive tracers such as Iodine-131 in nuclear medicine; radioimmuno-assays for testing constituents of blood, serum, urine, hormones and antigens; and radiotherapy that destroys damaged cells (ACSCH011).**Use of radioisotopes requires careful evaluation and monitoring because of the potential harmful effects to humans and/or the environment if their production, use and disposal are not managed effectively (ACSCH013).* |
| **Particle accelerators*** operation and role of ANSTO particle accelerators
* Linear particle accelerators are used to conduct dating of materials and environmental research using accelerator mass spectrometry
 | **Science Understanding**Mass spectrometry involves the ionisation of substances and generates spectra which can be analysed to determine the isotopic composition of elements (ACSCH023)**Science as a Human Endeavour**Scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability (ACSCH015)**(Example in context)** *Radioisotopes have a wide variety of uses, including Carbon-14 for carbon dating in geology and palaeobiology; radioactive tracers such as Iodine-131 in nuclear medicine; radioimmuno-assays for testing constituents of blood, serum, urine, hormones and antigens; and radiotherapy that destroys damaged cells (ACSCH011).* |
| **Videoconference content** | **Curriculum links** |
| **Radiation penetration Investigation*** Detect radiation produced by some radioactive sources to investigate
* How radioactive are different household objects?
* Which of these sources should we should choose for the experiment and why?
* Carry out a scientific investigation, including a discussion of the scientific method applied, to investigate one of the following (selected by the teacher prior to the videoconference):
	+ How does radioactivity change with distance from the source?
	+ How does the thickness of a shielding material affect radiation penetration?
	+ How do different types of shielding material affect radiation penetration?
 | **Science Inquiry Skils**Identify, research and refine questions for investigation; propose hypotheses; and predict possible outcomes (ACSCH001)Design investigations, including the procedure/s to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics (ACSCH002)Conduct investigations, including the use of devices to accurately measure temperature change and mass, safely, competently and methodically for the collection of valid and reliable data (ACSCH003)Represent data in meaningful and useful ways, including using appropriate graphic representations and correct units and symbols; organise and process data to identify trends, patterns and relationships; identify sources of random and systematic error and estimate their effect on measurement results; and select, synthesise and use evidence to make and justify conclusions (ACSCH004) |