

Nuclear Science in Society

Developed for ANSTO by Galen Neubronner, Science Teachers Association of NSW

2005 Junior Program Year 9

Unit 9.X: ANSTO Sample Program – Building A Better Nuclear Reactor

Suggested Length: 3 weeks

PFA's (P)

Applications and uses of science

- a) Identify and describe examples of scientific concepts and principles that have been used in technological developments (including Australian examples).
- b) Discuss, using examples, the positive and negative impacts of applications of recent developments in science.

Implications for society and the environment

- a) Discuss viewpoints about some issues with a major scientific component.
- b) Give examples to show that different societal groups may use or weight criteria differently to make a decision about an issue involving a major scientific component.
- c) Discuss the place of social and ethical considerations in scientific practice and in applications of science.

Current issues, research and development

- a) Evaluate the potential impact of some issues raised in the mass media that require some scientific understanding.

Domains (D):

5.6 applies basic physical models, theories and laws to situations involving energy, force and motion.

5.6.5 Nuclear energy to:

- a) Identify that energy may be released from the nuclei of atoms.

explain radioactivity in terms of release of particles and energy discuss similarities and differences between nuclear fission and fusion

5.7 relates properties of elements, compounds and mixtures to scientific models, theories and laws.

5.7.1 atomic theory to:

- a) Describe features of and the location of protons, neutrons and electrons in the atom.
- b) Distinguish between elements, using information about the numbers of protons, neutrons and electrons.
- c) Describe an appropriate model that has been developed to describe atomic structure.

trace the history of atomic theory

5.7.2 elements to:

- a) Identify the atom as the smallest unit of an element and distinguish between atoms and molecules.

5.10 assesses human impacts on the interaction of biotic and abiotic features of the environment.

- a) Describe some impacts of human activities on ecosystems.

5.11 analyses the impact of human resource use on the biosphere to evaluate methods of conserving, protecting and maintaining Earth's resources.

5.11.1 energy resources to:

- a) Discuss the importance of energy as a resource
- b) Identify properties that make some natural resources economically important and describe their uses.

5.11.2 waste from resource use to:

- a) Relate pollution to contamination by unwanted substances.
- b) Identify excessive use of fossil fuels as a contributing factor to a greenhouse effect.
- c) Discuss strategies used to balance human activities and needs in ecosystems with conserving, protecting and maintaining the quality and sustainability of the environment.

discuss economic and environmental impacts of mining and resource exploration

evaluate costs and benefits of various sources of energy, including those available to remote communities.

5.12 describes scientific principles underlying some common technologies.

5.12 technology to:

- a) Discuss the benefits and problems associated with medical and industrial uses of nuclear energy

discuss technological developments that have extended the ability of scientists to collect information about, and monitor events in, the natural and physical worlds.

Skills (S)

4/5.13.1 identify data sources

- a) Identify the appropriate units to be used in collecting data.

4/5.15 Obtains results from experiments

- a) Make and record observations and measurements accurately over a number of trials.

5.16 gather information from secondary sources to:

- a) Use a range of sources, including CD-ROMs and the internet, to access information. (5.16a)
- b) Use key words, skimming and scanning techniques to identify appropriate information. (5.16b)
- c) Extract information from column graphs, histograms, divided bar and sector graphs, line graphs, composite graphs, flow diagrams, other texts and audio/visual resources. (5.16c)
- d) Summarise information from identified oral and written secondary sources. (5.16d)

5.17 explains trends, patterns and relationships in data and/or information from a variety of sources.**5.17 process information to:**

- a) Collate information from a number of sources. (5.17a)
- b) Distinguish between relevant and irrelevant information. (5.17b)
- c) Check the reliability of gathered data and information by comparing them with observations or information from other sources. (5.17c)
- d) Organise data using a variety of methods including diagrams, tables, spreadsheets and databases. (5.17d)
- e) Critically analyse the accuracy of scientific information presented in mass media. (5.17e)

5.18 selects and uses appropriate forms of communication to present information to an audience.**5.18 present information to:**

- a) Select and use an appropriate medium to present data and information. (5.18b)
- b) Select and use an appropriate method to acknowledge sources of information. (5.18c)
- c) Use symbols to express relationships, including mathematical ones, and appropriate units for physical quantities. (5.18d)
- d) Use drawings, diagrams, graphs, tables and flow charts to show relationships and present information clearly and/or succinctly. (5.18e)

5.19 uses critical thinking skills in evaluating information and drawing conclusions.**5.19 think critically to:**

- a) Justify inferences in light of gathered information. (5.19a)
- b) Identify data which support or discount a hypothesis, a question being investigated or a proposed solution to a problem. (5.19b)
- c) Predict outcomes and generate plausible explanations directly related to observation made. (5.19c)
- d) Make generalisations in relation to a relevant set of observations or experimental results. (5.19d)
- e) Use models, including mathematical ones, to explain phenomena or make predictions. (5.19f)
- f) Use cause and effect relationships to explain ideas. (5.19g)

5.21 uses creativity and imagination in the analysis of problems and the development of possible solutions.**5.21 use creativity and imagination to:**

- a) Seek evidence to support claims. (5.21a)
- b) Evaluate evidence for reliability and validity. (5.21b)
- c) Produce creative solutions for problems. (5.21c)
- d) Propose ideas that demonstrate coherence and logical progression. (5.21d)
- e) Apply critical thinking in the consideration of proposals. (5.21e)
- f) Formulate cause and effect relationships. (5.21f)

5.24 respects different viewpoints and is honest and fair in dealing with others.

- a) Show flexibility and responsiveness to ideas and evidence. (5.24d)
- b) Appreciate the need to assess opinions and values within the community. (5.24f)

5.25 recognises the relevance and importance of lifelong learning.

- a) Acknowledge the continued impact of science in many aspects of everyday life. (5.25a)

5.26 recognises the role of science in providing information about issues being considered and in increasing an understanding of the world around them.

- a) Show awareness that scientists must be accountable for their actions. (5.26c)
- b) Appreciate that scientific information should be disseminated objectively. (5.26d)
- c) Appreciate that scientific theories can only be judged on the basis of scientific evidence. (5.26e)
- d) Appreciate the need for careful assessment of science reports in the media. (5.26f)

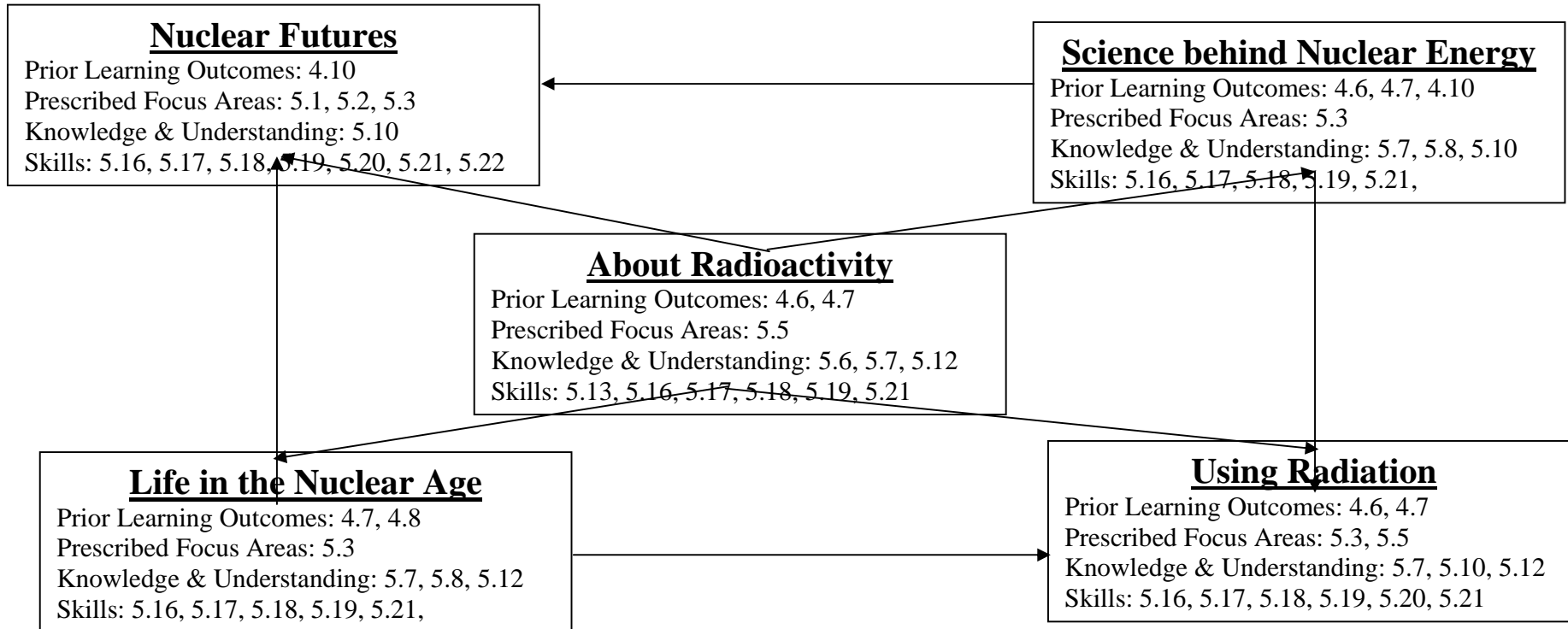
5.27 acknowledges their responsibility to conserve, protect and maintain the environment for future generations.

- a) Demonstrate a commitment to conserving and improving the quality of society and the environment. (5.27b)

CONTEXT

Congratulations! Mr. Burns has just promoted you to Springfield’s newest Chief Nuclear Engineer. He has commissioned you to build a new nuclear power plant after one of his employees, Homer Simpson, accidentally left a peanut butter sandwich on his work station desk and caused a meltdown... Of course, your new reactor will have to be Homer-proof...

CONTEXTUAL OUTLINE



ABORIGINALITY (red worksheets)

Although Springfield is set in some unidentified area of the United States of America, somehow some Australian aboriginals have always been living here, at least since Dreamtime. Even so, Mr. Burn's approach to reconciliation is somewhat dubious and hence there are no worksheets on Aboriginality for this topic...

LITERACY (green worksheets)

- Activity 1.1 Types of radiation: brainstorm radiations that you know of.
- Activity 1.3 Radiation versus radioactivity: define radiation, nuclear radiation and radioactivity.
- Activity 1.4 Sources of radiation: prepare a table showing the type of radiation and its source
- Activity 1.6 Subatomic particles: identify the atomic and mass numbers of materials and then complete a mix and match activity to compare changes to atoms with the addition of different subatomic particles.
- Activity 1.8 Nuclear Fission and fusion: Fill in the blanks
- Activity 2.1 Effects on living cells: write a passage
- Activity 2.2 Safe Doses: Describe the effects of nuclear radiation and shielding on humans.
- Activity 3.1 The hidden costs of electricity generation: compare coal and nuclear
- Summary Task 3 – Nuclear tools: Research and report on an example of either a nuclear technology or nuclear research program in Australia
- Summary Task 4 – Mine your Mind. Assessment

ICT (yellow worksheets)

- Activity 1.3 Radiation versus radioactivity: define radiation, nuclear radiation and radioactivity (using internet)
- Activity 1.4 Sources of radiation: prepare a table showing the type of radiation and its source (WP)
- Radioactive dice Experiment: Graphing using Spreadsheet.
- Activity 2.1 Effects on living cells: write a passage (WP)
- Activity 2.2 Safe Doses: Describe the effects of nuclear radiation and shielding on humans.
- Activity 3.1 The hidden costs of electricity generation: compare coal and nuclear
- Summary Task 3 – Nuclear tools: Research and report on an example of either a nuclear technology or nuclear research program in Australia
- Summary Task 4 – Mine your Mind. Assessment

Learning to Learn (purple worksheets)

Research and Inquiry

Mind Mapping

- Activity 1.1 Types of radiation

Thinking and Learning Styles

Multiple Intelligences

- Radioactive Dice Experiment (logical)
- Activity 1.9 Student fission (kinaesthetic)

Thinking Skills

Problem-Solving Strategies

- Activity 1.5 Types of nuclear radiation
- Activity 1.6 Subatomic particles.
- Activity 1.7 Radioactive decay.

Six Thinking Hats

- Activity 3.1 The hidden costs of electricity generation: compare coal and nuclear
- Summary Task 3 – Nuclear tools
- Summary Task 4 – Mine your Mind.

ASSESSMENT OUTLINE (Buff colour)

Present an outline of the need and specifications for a power nuclear reactor in Springfield.

References:

- T1 At the time of writing, new textbooks are becoming available for the science syllabus, thus it is inappropriate to reference older books.
- W1 ANSTO Resource CD
- W2 www.ansto.gov.au
- V1 Nuclear Physics

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
5.6.5 nuclear energy to	a) identify that energy may be released from the nuclei of atoms	Using a teacher-supplied scaffold, brainstorm, in small groups, radiations that you know of by <ul style="list-style-type: none"> collating information from a number of sources. (5.17a) distinguishing between relevant and irrelevant information. (5.17b) <i>Activity 1.1 Types of radiation</i>	Hand in completed table.	10 min					
		identify radiations in Activity 1.1 as either Electromagnetic or Nuclear by <ul style="list-style-type: none"> making generalisations in relation to a relevant set of observations or experimental results. (5.19d) <i>Activity 1.2 Electromagnetic and nuclear radiation</i>	Hand in completed table.	15 min					
		Define radiation, nuclear radiation and radioactivity by <ul style="list-style-type: none"> using a range of sources, including CD-ROMs and the internet, to access information. (5.16a) using key words and scanning techniques to identify appropriate information. (5.16b) <i>Activity 1.3 Radiation versus radioactivity</i>	Hand in completed definitions.	20 min					
Applications and uses of science	a) identify and describe examples of scientific concepts and principles that have been used in technological developments (including Australian examples)	After viewing teacher-selected materials, students prepare a table showing the type of radiation and its source by <ul style="list-style-type: none"> using a range of sources, including CD-ROMs and the internet, to access information. (5.16a) using key words & skimming techniques to identify appropriate information. (5.16b) summarising information from identified written secondary sources. (5.16d) selecting & using an appropriate method to acknowledge sources of information. (5.18c) <i>Activity 1.4 Sources of radiation</i>	Hand in completed table.	50 min					
5.6.5 nuclear energy to	a) identify that energy may be released from the nuclei of atoms	After viewing teacher-selected materials, identify types of nuclear radiation by their properties by <ul style="list-style-type: none"> justifying inferences in light of gathered information. (5.19a) 	Hand in Activity 1.5	50 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
		<ul style="list-style-type: none"> identifying data which support or discount a hypothesis, a question being investigated. (5.19b) predicting outcomes and generate plausible explanations directly related to observation made. (5.19c) making generalisations in relation to a relevant set of observation.(5.19d) using models of the atom to explain phenomena or make predictions. (5.19f) using cause and effect relationships to explain ideas. (5.19g) <p><i>Activity 1.5 Types of nuclear radiation</i></p>							
5.7.1 atomic theory to	<p>a) describe features of and the location of protons, neutrons and electrons in the atom.</p> <p>b) distinguish between elements, using information about the numbers of protons, neutrons and electrons.</p> <p>c) describe an appropriate model that has been developed to describe atomic structure.</p>	<p>After viewing teacher-selected materials, identify the atomic and mass numbers of materials and then complete a mix and match activity to compare changes to atoms with the addition of different subatomic particles by</p> <ul style="list-style-type: none"> using models, including mathematical ones, to explain phenomena or make predictions. (5.19f) formulating cause and effect relationships. (5.21f) <p><i>Activity 1.6 Subatomic particles</i></p>	<p>Pencil and paper tests on atomic structure.</p> <p>Hand in Activity 1.6</p>	50 mins					
5.6.5 nuclear energy to:	<i>(extension): explain radioactivity in terms of release of particles and energy</i>	<p>Students model radioactive decay using dice by</p> <ul style="list-style-type: none"> identifying the appropriate units to be used in collecting data (5.13e). making and record observations and measurements accurately over a number of trials (5.15a). 	<p>Activity 1.7 Radioactive decay: pencil and paper test</p> <p>Students present final experimental report.</p>	50 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
		<ul style="list-style-type: none"> selecting an appropriate way to present information (eg typed, PowerPoint presentation, model, etc) (5.18b) using symbols to express relationships, including mathematical ones, and appropriate units for physical quantities. (5.18d) using graphs to show relationships and present information clearly and/or succinctly. (5.18e) selecting and drawing the appropriate type of graph (from column graph, histogram, divided bar, sector or line graph) or diagram to convey information and relationships clearly and accurately. (5.18f) justifying inferences in light of gathered information. (5.19a) identifying data which support or discount a hypothesis. (5.19b) predicting outcomes and generate plausible explanations directly related to observations made. (5.19c) making generalisations in relation to a relevant set of experimental results. (5.19d) <p>WS: Radioactive Dice</p>							
5.6.5 nuclear energy to:	<i>(extension): discuss similarities and differences between nuclear fission and fusion</i>	<p>After viewing teacher-selected materials, students complete an exercise to fill in the blanks by</p> <ul style="list-style-type: none"> justifying inferences in light of gathered information. (5.19a) identifying data which support or discount a hypothesis, a question being investigated or a proposed solution to a problem. (5.19b) predicting outcomes and generate plausible 	Hand in Activity 1.8	30 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
		explanations directly related to observation made. (5.19c) • making generalisations in relation to a relevant set of observations. (5.19d) <i>Activity 1.8 Nuclear Fission and Fusion</i>							
	<i>(extension): explain radioactivity in terms of release of particles and energy</i>	Students simulate fission kinaesthetically by • making and record observations and measurements accurately over a number of trials (5.15a). • selecting an appropriate way to present information (eg typed, PowerPoint presentation, model, etc) (5.18b) • using graphs to show relationships and present information clearly and/or succinctly. (5.18e) • justifying inferences in light of gathered information. (5.19a) • identifying data which support or discount a hypothesis. (5.19b) • predicting outcomes and generate plausible explanations directly related to observations made. (5.19c) • making generalisations in relation to a relevant set of experimental results. (5.19d) <i>Activity 1.9 Student fission – a simulation activity</i>	Students submit an experimental report or passage based on the simulation activity.	50 mins					
	<i>explain radioactivity in terms of release of particles and energy</i>	write a passage on the effect of nuclear radiation on living cells by • seeking evidence to support claims. (5.21a) • evaluating evidence for reliability and validity. (5.21b) • producing creative solutions for problems. (5.21c) • proposing ideas that demonstrate coherence and logical progression. (5.21d) • applying critical thinking in the consideration of proposals. (5.21e) • formulating cause and effect relationships.	Students submit their written passage.	30 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
		(5.21f) <ul style="list-style-type: none"> • showing flexibility and responsiveness to ideas and evidence. (5.24d) • appreciating the need to assess opinions and values within the community. (5.24f) <i>Activity 2.1 Effects on living cells</i>							
Applications and uses of science	b) discuss, using examples, the positive and negative impacts of applications of recent developments in science	Using a teacher-supplied scaffold, describe the effects of nuclear radiation and shielding on humans by <ul style="list-style-type: none"> • seeking evidence to support claims. (5.21a) • evaluating evidence for reliability and validity. (5.21b) • producing creative solutions for problems. (5.21c) • proposing ideas that demonstrate coherence and logical progression. (5.21d) • applying critical thinking in the consideration of proposals. (5.21e) • formulating cause and effect relationships. (5.21f) <i>Activity 2.2 Safe Doses?</i>	Students had in activity 2.2	40 mins					
Applications and uses of science	b) discuss, using examples, the positive and negative impacts of applications of recent developments in science	Students create a board game that describes aspects of radiation hazards by <ul style="list-style-type: none"> • producing creative solutions for problems. (5.21c) • proposing ideas that demonstrate coherence and logical progression. (5.21d) • applying critical thinking in the consideration of proposals. (5.21e) • formulating cause and effect relationships. (5.21f) <i>Summary Task 2 Life in the Nuclear Board Game</i>	Students produce the board game and undergo peer and teacher evaluation through play.	100 mins					
5.11.1 energy resources to	a) discuss the importance of energy	After consideration of teacher-supplied materials, students compare electrical power		120 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
	as a resource b) identify properties that make some natural resources economically important and describe their uses.	generation by coal and nuclear technologies by <ul style="list-style-type: none"> • seeking evidence to support claims. (5.21a) • evaluating evidence for reliability and validity. (5.21b) • proposing ideas that demonstrate coherence and logical progression. (5.21d) • applying critical thinking in the consideration of proposals. (5.21e) • formulating cause and effect relationships. (5.21f) • showing flexibility and responsiveness to ideas and evidence. (5.24d) • appreciating the need to assess opinions and values within the community. (5.24f) • acknowledging the continued impact of science in aspects of everyday life. (5.25a) • appreciating that scientific information should be disseminated objectively. (5.26d) • appreciating the need for careful assessment of science reports in the media. (5.26f) <i>Activity 3.1 The hidden costs of electricity generation</i>							
Implications for society and the environment 5.11.2 waste from resource use to	b) give examples to show that different societal groups may use or weight criteria differently to make a decision about an issue involving a major scientific component e) discuss the place of social and ethical considerations in scientific practice and in applications of science. a) relate pollution to	Research and report on an example of either a nuclear technology or nuclear research program in Australia <ul style="list-style-type: none"> • seeking evidence to support claims. (5.21a) • evaluating evidence for reliability and validity. (5.21b) • proposing ideas that demonstrate coherence and logical progression. (5.21d) • applying critical thinking in the consideration of proposals. (5.21e) • formulating cause and effect relationships. (5.21f) • showing flexibility and responsiveness to ideas and evidence. (5.24d) • appreciating the need to assess opinions and values within the community. (5.24f) 	Students submit their research report.	120 mins					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
	contamination by unwanted substances. b) identify excessive use of fossil fuels as a contributing factor to a greenhouse effect. c) discuss strategies used to balance human activities and needs in ecosystems with conserving, protecting and maintaining the quality and sustainability of the environment.	<ul style="list-style-type: none"> acknowledging the continued impact of science in many aspects of everyday life. (5.25a) showing awareness that scientists must be accountable for their actions. (5.26c) appreciating that scientific information should be disseminated objectively. (5.26d) appreciating that scientific theories can only be judged on the basis of scientific evidence. (5.26e) appreciating the need for careful assessment of science reports in the media. (5.26f) <p><i>Summary Task 3 – Nuclear tools</i></p>							
Current issues, research and development 5.12 technology to	b) evaluate the potential impact of some issues raised in the mass media that require some scientific understanding b) discuss the benefits and problems associated with medical and industrial uses of nuclear energy	<p>Students prepare a report about the benefits and problems associated with medical and industrial uses of nuclear energy using the Springfield plants as an example by</p> <ul style="list-style-type: none"> seeking evidence to support claims. (5.21a) evaluating evidence for reliability and validity. (5.21b) producing creative solutions for problems. (5.21c) proposing ideas that demonstrate coherence and logical progression. (5.21d) applying critical thinking in the consideration of proposals. (5.21e) formulating cause and effect relationships. (5.21f) showing flexibility and responsiveness to ideas 	Assessment.	100 min					

Syllabus Outcomes	Syllabus Content Statement	Core Learning Experiences	Evidence of Learning (Feedback)	Time (lessons)	Register				
					9.1	9.2	9.3	9.4	9.5
A student:	Students learn about/to:		Student:						
		and evidence. (5.24d) <ul style="list-style-type: none"> • appreciating the need to assess opinions and values within the community. (5.24f) • acknowledging the continued impact of science in many aspects of everyday life. (5.25a) • showing awareness that scientists must be accountable for their actions. (5.26c) • appreciating that scientific information should be disseminated objectively. (5.26d) • appreciating that scientific theories can only be judged on the basis of scientific evidence. (5.26e) • appreciating the need for careful assessment of science reports in the media. (5.26f) Summary Task 4 – Mine your Mind WS – Glowing with Health							

Glossary**Terms in italics are optional**

Atom	Physical (change)
Biotechnology	Pollution
Column graph	Pressure
Compound	Property
Control	Proton
DNA	Radiation
Electromagnetic	Radioactivity
Electron	Resource
Electrostatic	Science
Element	Speed
Energy	Subatomic
Environment	Sun
Ethical	Technology
<i>Fission (nuclear)</i>	Temperature
Force	Wave
Formula (chemical)	Wavelength
Fossil	
Fossil fuel	
<i>Fusion (nuclear)</i>	
<i>Global warming</i>	
Greenhouse gas	
Human	
<i>Indigenous</i>	
Kinetic	
Light	
Made resource	
Mass	
Matter	
Metal	
Model	
Motion	
Natural resource	
Non-renewable energy	
Nucleus (atomic)	
Particle	

Evaluation

Name:

	Strongly Disagree			Strongly Agree	
1. The time allocation for this program is appropriate	1	2	3	4	5
Comment:	_____				
2. The PFAs, Domains & Skills are appropriate	1	2	3	4	5
Comment:	_____				
3. The context is suitable and enjoyable.	1	2	3	4	5
Comment:	_____				
4. Cross-curricular activities are appropriate	1	2	3	4	5
Comment:	_____				
5. The lesson sequence is appropriate	1	2	3	4	5
Comment:	_____				
6. Assessment for Learning strategies are appropriate.	1	2	3	4	5
Comment:	_____				
7. The assessment is suitable.	1	2	3	4	5
Comment:	_____				
8. Teaching strategies and activities are appropriate	1	2	3	4	5
Comment:	_____				
9. Any additional teaching strategies or resources:					

General Comments:

Year 9 Building a Better Nuclear Reactor Lesson Sequence

CONTEXT

Congratulations! Mr. Burns has just promoted you to Springfield's newest Chief Nuclear Engineer. He has commissioned you to build a new nuclear power plant after one of his employees, Homer Simpson, accidentally left a peanut butter sandwich on his work station desk and caused a meltdown... Of course, your new reactor will have to be Homer-proof...

Each Topic below Refers to the Website: ANSTO Nuclear Science in Society (2004)

Classwork	What I already know	Tasks I can do to achieve the class work.	Due date	Homework	Glossary
1. Read Topic 1: What is Nuclear Radiation?		Activity 1.1 Types of radiation to Activity 1.5 Types of nuclear radiation			Terms in italics are optional Atom Electromagnetic Electron Electrostatic Element Energy Environment Ethical <i>Fission (nuclear)</i> Force Fossil fuel <i>Fusion (nuclear)</i> Global warming Greenhouse gas Human <i>Indigenous</i> Kinetic Light Made resource Mass Matter Metal Model Natural resource Non-renewable energy
2. Read Topic 2: Radioactivity and the Atom		Activity 1.6 Subatomic particles Activity 1.7 Radioactive decay Experiment: Radioactive Dice			
3. Read Topic 3: Neutrons and Fission		Activity 1.8 Nuclear Fission and fusion Activity 1.9 Student fission		Summary Task 1: Radiation & Subatomic Particles	
4. Read Topic 4: Biological effects of nuclear radiation		Activity 2.1 Effects on living cells Activity 2.2 Safe Doses?			
5. Read Topics 5 & 6: Controlling the Atom and Current Controversies				Summary task 2: Life in the Nuclear Board Game	
6. Read Topic 7: Nuclear Energy		Activity 3.1 The hidden costs of electricity generation			
7. Read Topics 8 & 9: Radiation for research, medicine & industry				Summary Task 3: Nuclear Tools	

STANSW/ANSTO Stage 5 Program – Building A Better Nuclear Reactor

Classwork	What I already know	Tasks I can do to achieve the class work.	Due date	Homework	Glossary
8. Read Topics 10-12: Bombs & Breakthroughs; Nuclear Technology in Australia; How does Society Decide?				Summary Task 4: Mine your Mind.	Nucleus (atomic) Particle Pollution Property Proton Radiation Radioactivity Resource Subatomic Sun Technology Temperature Wave

Assessment

Topic 1

Activity 1.1 Types of radiation: brainstorm radiations that you know of.

Activity 1.2 Electromagnetic and nuclear radiation: Identify radiations in 1.1 as either EM or N.

Activity 1.3 Radiation versus radioactivity: Define radiation, nuclear radiation and radioactivity.

Activity 1.4 Sources of radiation: Prepare a table showing the type of radiation and its source

Activity 1.5 Types of nuclear radiation: Identify types of nuclear radiation by their properties.

Topic 2

Activity 1.6 Subatomic particles: Identify the atomic and mass numbers of materials and then complete a mix and match activity to compare changes to atoms with the addition of different subatomic particles.

Activity 1.7 Radioactive decay: Pencil and paper test.

Radioactive dice game.

Topic 3

Activity 1.8 Nuclear Fission and Fusion: Fill in the blanks

Activity 1.9 Student fission – a simulation activity: radioactive students.

Summary Task 1: Radiation and Subatomic Particles. Complete tables of isotopes and subatomic particles.

Topic 4

Activity 2.1 Effects on living cells: Write a passage

Activity 2.2 Safe Doses: Describe the effects of nuclear radiation and shielding on humans.

Summary Task 2: Life in the Nuclear Age Board Game.

Topic 7

Activity 3.1 The hidden costs of electricity generation: Compare coal and nuclear

Summary Task 3: Nuclear tools: Research and report on an example of either a nuclear technology or nuclear research program in Australia

Summary Task 4: Mine your Mind. Assessment

STANSW/ANSTO Stage 5 Program – Building A Better Nuclear Reactor

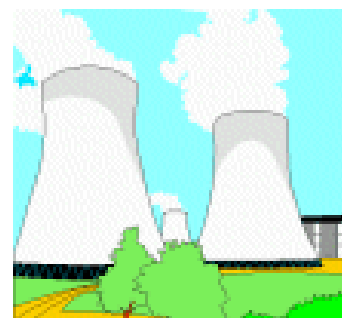
- d) use symbols to express relationships, including mathematical ones, and appropriate units for physical quantities.
- e) use graphs to show relationships and present information clearly and/or succinctly.
- f) select and draw the appropriate type of graph (from column graph, histogram, divided bar, sector or line graph) or diagram to convey information and relationships clearly and accurately.

Year 9 Science – Glowing with Health...

Name: _____

Context

Should we have a nuclear reactor in Sydney? In this worksheet, we will look at some of the issues involved with nuclear materials produced by nuclear reactors.



What to Do

The end product of this worksheet is a 500 major word (approximately 2 A4 pages written) essay entitled

“Analyse our use of nuclear energy in medicine and industry in Sydney.”

Analyse means to identify components and the relationship between them; draw out and relate implications.

To do this essay, answer the following steps:

1. Locate three articles on the use of nuclear materials in Sydney, with at least one medical and at least one industrial use. For each article
 - (a) identify the nuclear material used.
 - (b) Describe the use of the nuclear material in the named application.
 - (c) Identify properties of the nuclear material that make it useful for this application.
 - (d) If possible, describe other, non-nuclear ways of achieving the same result.
 - (e) Describe the benefits and problems associated with using the nuclear material.
2. For each use, fill in the information table overleaf.
3. After investigating these three areas, in one paragraph, give your opinion about whether Sydney should have a nuclear reactor, based on what you have found.
4. Fill in the scaffold that structures how to write the essay.
5. Using the information table and the scaffold, write the essay. Include a bibliography.

Skills

In this lesson, you will be developing the following skills:

Science Skills

4/5.16. **Uses information** from a wide variety of sources

- a) Uses a range of sources, including books, internet and library databases
- b) Able to understand and use key words in order to locate appropriate information.
- c) Summarise / draw together important and relevant information from the sources used

4/5.17. **Organises information:**

- a) Organises information from a variety of sources.
- c) Organises information / research into a structure e.g. a diagram or note taking guide.

4/5.18. **Presents Information:**

- c) Uses the appropriate format for acknowledging where you have found the information.

4/5.19 **Uses critical thinking:**

- a) justify inferences using gathered information.
- b) identify data and information which support or discount a hypothesis, a question being investigated or a proposed solution to a problem.

4/5.21 **Use creativity and imagination to:**

- e) Consider all the pros and cons for a proposal.
- f) Identify causes and the effects they create.

4/5.24 **respects different viewpoints and is honest and fair in dealing with others.**

- d) show flexibility and responsiveness to ideas and evidence.
- f) appreciate the need to assess opinions and values within the community.

4/5.25 **recognises the relevance and importance of lifelong learning.**

- a) acknowledge the continued impact of science in many aspects of everyday life.

4/5.26 **recognises the role of science in providing information about issues being considered and in increasing an understanding of the world around them.**

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- c) show awareness that scientists must be accountable for their actions.
- d) appreciate that scientific information should be disseminated objectively.
- f) appreciate the need for careful assessment of science reports in the media.

Information Table

Principle	Application 1	Application 2	Application 3
Nuclear material used.			
Use of nuclear material in application.			
Properties of nuclear material that make it useful.			
Non-nuclear way of achieving the same result.			
Benefits of using the nuclear material.			
Problems with using the nuclear material.			

Analyse

Identify components and the relationship between them; draw out and relate implications.

