

## IMPACT OF RADIATION RESEARCH LET IT GLOW!

### Performance Standards 12C/11A/13A/13B.J

Students will apply scientific inquiries to explain atomic and sub-atomic structures and energy accordingly:

- *Knowledge*: understand the foundational concepts of atomic structures and their isotopic connections.
- *Application*: research the progress of research, uses and safety issues associated with isotopes in medicine.
- *Communication*: compare research findings about isotopes in medicine from the perspective of an employee, patient and the medical facility.

### Procedures

1. ***In order to know and apply concepts that describe properties of matter and energy and the interactions between them (12C); the concepts, principles and processes of scientific inquiry (11A); the accepted practices of science (13A); and concepts that describe the interaction between science, technology and society (13B)***, students should experience sufficient learning opportunities to develop the following:

- Review literature associated with the progress through history of the use of radioactive isotopes in medicine.
- Examine applicable existent surveys, impact studies or models about the effects of radioactive (RA) isotopes on patients, health care professionals and medical facilities.
- Design an issue investigation for studying the effects of RA isotopes.
- Propose applicable survey and interview instruments and methodologies for each of the three impact groups (patients, professionals, facility management).
- Project possible viewpoints, variables, applicable data sets and formats for consideration in the investigation.
- Conduct the issue investigation, using applicable technologies and interviewing experts.
- Complete all data collection requirements.
- Interpret and analyze results to produce findings.
- Determine basis of inferences, deductions and perceptions.
- Report and display the findings from the investigation.
- Compare findings from different impact groups.
- Generalize the responses from the different groups.
- Generate further questions or issues for consideration.

Note to teacher: This activity relates to knowledge associated with Standard 12C, while addressing Performance Descriptors for Stage J within Standard 11A as an issue investigation. Applying the accepted practices of science (including the principles of safety) in Standard 13A is foundational. Applying the societal implications of this scientific research addresses Performance Descriptors in 13B. Student should already have studied basic chemistry, i.e., atomic structures and energy and isotopic structures, and have a basic understanding of the use of RA isotopes in medicine. Health Occupations students need to be aware of safety issues concerning areas of diagnosis. They need to be able to make informed decisions concerning the use of potentially dangerous materials.

2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Begin this issue investigation with student input about “Who is affected by the use of radioactive isotopes in medicine?” Probable groups include the patients, the health care professionals and the medical facility itself. As they continue brainstorming, they should begin to answer, “How are these people/facilities affected by the use of the radioactive isotopes?” The issue to be addressed eventually is whether the positive effects outweigh the negative effects from the use of radioactive isotopes. Students may offer anecdotal references, which should be generalized, associated with the kind of ailment/diagnosis, safety considerations and long-term effects. As the ideas are being generated, create a matrix which can chart the generalized issues associated with each group. A possible matrix is provided which can organize group work and research around suggested impact groups associated with the use of RA isotopes. Delegate individual or groups of students to research their component for an informational presentation to the class. Their research should include interviews of members of each impact group. Students should propose questions that can be asked in each impact group, so that their findings can be generalized. Class presentations should provide factors and evidence about the positive and negative

effects of the use of RA isotopes. After the presentations, students will discuss the original issue – whether the positive effects outweigh the negative effects from the use of radioactive isotopes. Students will respond to the issue question individually, providing factual evidence and personal reflections.

4. Evaluate each student's work using the Science Rubric as follows, and add the scores to determine the performance level:
  - *Knowledge*: The foundational concepts of radiation chemistry and the applications in the medical field are explained accurately and completely.
  - *Application*: The comparative research about the research, uses and safety issues associated with medical radiation chemistry is complete and accurate.
  - *Communication*: The findings from class discussion and personal reflections show insightful and evidence-based conclusions from the perspectives of employees, patients and medical facility management.

#### **Examples of Student Work**

- [Meets](#)
- [Exceeds](#)

#### **Resources**

- Class Matrix for Isotopic Impact Research
- Science Rubric

#### **Time Requirements**

- One-to-two class periods for introductory brainstorming and research assignments
- Three-to-four days (in or out of class) to complete interviews and research
- Two-to-three days for presentations, generalizations and reflections

**CLASS MATRIX FOR ISOTOPIIC IMPACT RESEARCH**

<b>Kind of treatment/ disease</b>  <b>Impact groups</b>	<b>Thyroid</b>	<b>Prostate</b>	<b>Ovarian/ Uterine</b>	<b>Breast</b>	<b>Bone</b>	<b>Others??</b>
<b>Employees</b> <ul style="list-style-type: none"> <li>• Handling precautions</li> <li>• Tolerances?</li> <li>• What else?</li> </ul>						
<b>Medical facilities</b> <ul style="list-style-type: none"> <li>• Storage regulations and logistics</li> <li>• Disposal regulations and logistics</li> <li>• What else?</li> </ul>						
<b>Patient</b> <ul style="list-style-type: none"> <li>• Detection of ailment</li> <li>• Treatment of ailment</li> <li>• What else?</li> </ul>						

## SCIENCE RUBRIC

Exceeds - must receive no more than one 3 and the rest 4s in the other areas of the rubric.

Meets - may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.

Approaches - may receive no more than one 1 and a combination of 2s, 3s or 4s, in the other areas of the rubric.

Begins - must receive at least a 1 in all 3 areas of the rubric.

	<b>KNOWLEDGE</b>	<b>APPLICATION</b>	<b>COMMUNICATION</b>
	Knows and understands scientific terms, facts, concepts, principles, theories and methods.	Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate.	Communicates scientific knowledge and applications through writing, speech and visual displays.
<b>4</b>	<ul style="list-style-type: none"> <li>• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.</li> </ul>	<ul style="list-style-type: none"> <li>• Applications are thorough, appropriate and accurate.</li> </ul>	<ul style="list-style-type: none"> <li>• Written, oral and/or visual communication is well organized and effective.</li> </ul>
<b>3</b>	<ul style="list-style-type: none"> <li>• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.</li> </ul>	<ul style="list-style-type: none"> <li>• Applications are mostly thorough, appropriate and accurate.</li> </ul>	<ul style="list-style-type: none"> <li>• Most of the written, oral and/or visual communication is well organized and effective.</li> </ul>
<b>2</b>	<ul style="list-style-type: none"> <li>• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.</li> </ul>	<ul style="list-style-type: none"> <li>• Applications are somewhat appropriate and accurate.</li> </ul>	<ul style="list-style-type: none"> <li>• Some of the written, oral and/or visual communication is organized and effective.</li> </ul>
<b>1</b>	<ul style="list-style-type: none"> <li>• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct.</li> </ul>	<ul style="list-style-type: none"> <li>• Applications are minimally appropriate and accurate.</li> </ul>	<ul style="list-style-type: none"> <li>• Little of the written, oral and/or visual communication is organized and effective.</li> </ul>
<b>0</b>	<ul style="list-style-type: none"> <li>• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.</li> </ul>	<ul style="list-style-type: none"> <li>• All applications are missing and/or incorrect.</li> </ul>	<ul style="list-style-type: none"> <li>• All of the written, oral or visual communication is missing and/or lacks organization.</li> </ul>
<b>Score</b>			