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| **Academic Vocabulary** |
| ElectronElectron CloudNucleusProtonNeutron | Atomic NumberMass NumberIsotopeNuclear SymbolAtomic MassAtomic Mass unit | Nuclear Decay (alpha, beta, gamma)Radioactivity, RadiationHalf lifeNuclear FissionNuclear Fusion |

**Due Date and Submission:**

* October 8th (A-day) and October 9th (B-day) on Canvas by midnight.
* Projects turned in after that will be considered late and being absent does not excuse you from this penalty. You will lose 5% per school day the project is late.
* Each person/partnership must do their own work. Working with another person/partnership will be considered cheating and be penalized.

**Objective:**

Students will be able to describe how and why nuclear chemistry is used in a real world application.

**Format:**

* youtube video, google slides/powerpoint with audio voice over (can be done with phone), imovie, etc
* Length should be 3-5 minutes
* Include visual aids that help the viewer understand the topic
* Audio done by the presenter(s)

**Student Directions:**

1. You may work alone or with partner of your choice from your class period
2. You will choose a topic related to nuclear chemistry to research (see list on next page).
3. Your research and presentation should address the following questions about the topic chosen:
	1. What is the topic? Is it obvious to the viewer/listener?
	2. What is the nuclear reaction involved in the topic you have chosen? Is it explained in a way that is easily understood? Is there a visual or equation representation of the reaction? (reactions: fission, fusion, decay)
	3. Did you include visual aids (images, diagrams, video (not to exceed 30 seconds total), etc) that illustrate your topic?
	4. Do you have audio that you provide that explains/supports the visual aid?
	5. Is your real world application clear to the viewer/listener?
4. You will then locate at least 3 credible sources to provide information on your chosen topic and include them on your presentation. Sources for all visual aids must also be included.
5. The presentation you create should be easy to understand and explained on a level that a middle school student could understand.
6. The quality of your sources, the quality of the visual aids used, and the quality of the audio, and the quality of the presentation itself are all features which will impact your grade on this project. Details can be found on the Grading Rubric Sheet.

**Topic Choices (choose one of the following):**

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| 1. Pick a specific radioactive element that is used frequently in either industry, homes, medicine, science, technology, etc. Explain how, why, and safety concentration.
 | 1. Uses of radioactive element’s half-life in dating objects
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| 1. Radiation exposure levels of various activities such as airplane travel and x-rays
 | 1. The production of energy in the Sun
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| 1. The use of **nuclear** radiation to treat cancer (not all chemotherapy and cancer treatments are nuclear related and will not qualify)
 | 1. The use of radioactivity to diagnose cancer (not all tests are nuclear related and will not qualify)
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| 1. Radon gas in our homes
 | 1. The use of nuclear fission to produce electricity: pros and cons
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| 1. Sources of uranium for nuclear power plants and weapons
 | 1. Transportation of nuclear fuel and wastes
 |
| 1. Security concerns with nuclear power
 | 1. The Calloway County nuclear power plant: Nuclear energy in Missouri
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| 1. The use of nuclear fission in making nuclear warheads or bombs
 | 1. Decommissioning of nuclear warheads, weapons
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| 1. The concerns about nuclear wastes
 | 1. Pros and Cons of building a nuclear power plant in Green River Utah
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| 1. Radioactive hazardous waste sites and locations of nuclear waste sites
 | 1. Nuclear catastrophes that have happened in the past: Fukushima
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| 1. Nuclear catastrophes that have happened in the past: Chernobyl
 | 1. Nuclear catastrophes that have happened in the past: Three Mile Island
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| 1. How is nuclear power currently being used in the US?
 | 1. What are the future plans for using nuclear fission to generate electricity in the US?
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**Optional Resources**

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| **Websites containing Data and Information on Nuclear Topics** |
| **Source** | **Type of data/info** | **Website** |
| NIST | Half-life data | <http://www.nist.gov/pml/data/halflife.cfm> |
| EPA | Radon data and info | <http://www.epa.gov/radon/index.html> |
| WNO | Sources of radioactive materials | <http://www.world-nuclear.org/info/Safety-and-Security/Radiation-and-Health/Naturally-Occurring-Radioactive-Materials-NORM/><http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Uranium-Resources/Supply-of-Uranium/> |
| NRC | Radioactive wastes | <http://www.nrc.gov/waste.html><http://www.nrc.gov/waste/llw-disposal/licensing/statistics.html> |
| GAO | Radioactive Wastes | <http://www.gao.gov/key_issues/disposal_of_highlevel_nuclear_waste/issue_summary> |
| NIH | Radon and Cancer, Radiation levels, x-ray statistics | <http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=27><http://www.niehs.nih.gov/health/topics/agents/radon/> |
| FAS | Status of world nuclear forces | <http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/> |
| CDC | Number of x-ray visits | <http://www.cdc.gov/nchs/data/public_health/SeriesB_38.pdf> |
| ANS | Radiation dose chart | <http://www.ans.org/pi/resources/dosechart/> |
| NASA | Information about the sun’s energy | <http://helios.gsfc.nasa.gov/qa_sun.html> |
| NRDC | Archive of Nuclear weapons data | <http://www.nrdc.org/nuclear/nudb/datainx.asp><http://www.nrdc.org/nuclear/> |
| NRDC | Nuclear fallout regions for US plants | <http://www.nrdc.org/nuclear/fallout/> |
| Breast Cancer.org | Risk of developing breast cancer | <http://www.breastcancer.org/symptoms/understand_bc/risk/understanding> |
| ACS | Breast cancer facts and figures | [http://www.cancer.org/acs/groups/content/@editorial/documents/document/acspc-044552.pdf](http://www.cancer.org/acs/groups/content/%40editorial/documents/document/acspc-044552.pdf) |
| Cancer.org | Mammography statistics | <http://www.cancer.org/research/infographicgallery/mammography-statistics> |
| CDC | Fast stats mammography and breast cancer | <http://www.cdc.gov/nchs/fastats/mammography.htm> |
| NRC  | High value data sets on nuclear reactors | <http://www.nrc.gov/data/> |
| WNO | Transportation of nuclear wastes | <http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Transport/Transport-of-Radioactive-Materials/> |
| NEI | Nuclear waste | <http://www.nei.org/Knowledge-Center/Nuclear-Statistics/On-Site-Storage-of-Nuclear-Waste><http://www.nei.org/Knowledge-Center/Nuclear-Statistics/On-Site-Storage-of-Nuclear-Waste/US-State-by-State-Used-Fuel-and-Payments-to-the-Nu> |
| NRCNEI | Security and transportation of nuclear fuel | <http://www.nrc.gov/waste/spent-fuel-transp.html><http://www.nei.org/Issues-Policy/Nuclear-Waste-Management/Transportation> |
| NEI | Nuclear Statistics | <http://www.nei.org/Knowledge-Center/Nuclear-Statistics><http://www.nei.org/Knowledge-Center/Nuclear-Statistics/World-Statistics> |
| WNO  | Information and statistics on nuclear power | <http://www.world-nuclear.org/> |
| ICAN | International campaign to abolish nuclear weapons | <http://www.icanw.org/>Check “the Facts” tab |
| NRC | Decommissioning nuclear facilities | <http://www.nrc.gov/waste/decommissioning.html> |
| EIA | Nuclear power in Missouri | <http://www.eia.gov/nuclear/state/2008/missouri/> |
| NRC | Callaway County Reactor in MO | <http://www.nrc.gov/info-finder/reactor/call.html> |
| Nature | Fukushima radioactivity in food | <http://www.nature.com/news/fukushima-data-show-rise-and-fall-in-food-radioactivity-1.17016> |
| Fukushima Watch | Thyroid cancer and Fukushima | <http://www.fukushimawatch.com/2015-07-29-second-post-as-test-by-moshin.html> |
| WNN | The situation at Fukushima | <http://www.world-nuclear-news.org/RS_Data_on_Fukushima_radiation_monitoring_1809121.html> |
| WHO | Health effects of Chernobyl | <http://www.who.int/ionizing_radiation/chernobyl/backgrounder/en/> |
| NEI | Chernobyl disaster and its consequences | <http://www.nei.org/master-document-folder/backgrounders/fact-sheets/chernobyl-accident-and-its-consequences> |
| NRC | Background on Three Mile Island | <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html> |
| SI | Exhibit about three mile island | <http://americanhistory.si.edu/tmi/> |
| 3 mile islandorg | Health studies on what happened at 3 mile island  | <http://www.threemileisland.org/science/what_went_wrong/> |
| NIH | A re-evaluation of the health effects from 3 mile island | <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1469835/pdf/envhper00314-0052.pdf> |