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SCOUTMASTER BUCKY

Nuclear Science Merit Badge

SCOUTS PARTICIPATING IN A SCOUTMASTER BUCKY MERIT BADGE OPPORTUNITY (ONLINE OR IN PERSON), PLEASE CONSIDER ALSO USING THE NUCLEAR SCIENCE MERIT BADGE CLASS PREPARATION PAGE FOR CLARIFICATIONS, INSIGHTS, AND EXPECTATIONS.

https://scoutmasterbucky.com/merit-badges/nuclear-science/nuclear-science-cpp.pdf

NUCLEAR SCIENCE MERIT BADGE WORKBOOK

REQUIREMENT 1a: Explain radiation.

Notes:

REQUIREMENT 1a: Explain the difference between ionizing and non- ionizing radiation.

Notes:

REQUIREMENT 1b: Explain the ALARA principle

Notes:

REQUIREMENT 1b:	Explain the measures required by law to minimize these risks (related to ALARA principle).

Notes:

REQUIREMENT 1b:	Describe what safety requirements you will need to consider while performing the requirements in this merit badge.

Notes:

REQUIREMENT 1c:	Describe the radiation hazard symbol and explain where it should be used.

Notes:

REQUIREMENT 1d:	Explain how we are exposed to ionizing radiation from outside the earth as well as on earth every day.

Notes:

REQUIREMENT 1d:	List four examples of Naturally Occurring Radioactive Materials, NORM, which are in your house or grocery store and explain why they are radioactive.

EXAMPLE #1:

NORM #1 and where found:

Why this is radioactive:

EXAMPLE #2:

NORM #1 and where found:

Why this is radioactive:

EXAMPLE #3:
NORM #1 and where found:
Why this is radioactive:
EXAMPLE #4:
NORM #1 and where found:
Why this is radioactive:
REQUIREMENT 1e: Explain the difference between radiation exposure and contamination.
Radiation Exposure:
Radiation Contamination:

REQUIREMENT 1e:	Describe the hazards of radiation to humans, the environment, and wildlife.

Radiation Hazards to Humans:

Radiation Hazards to the Environment:

Radiation Hazards to Wildlife:

REQUIREMENT 1e:	Calculate your approximate annual radiation dose and compare to that of someone who works in a nuclear power plant.

Notes:

REQUIREMENT 2a:	Tell the meaning of the following: atom, nucleus, proton, neutron, electron, quark, isotope; alpha particle, beta particle, gamma ray, X-ray; ionization, radioactivity, radioisotope, and stability.

Atom:

Nucleus:

Proton:

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Neutron:
Electron:
Quark:
Isotope:
Alpha Particle:
Beta Particle:

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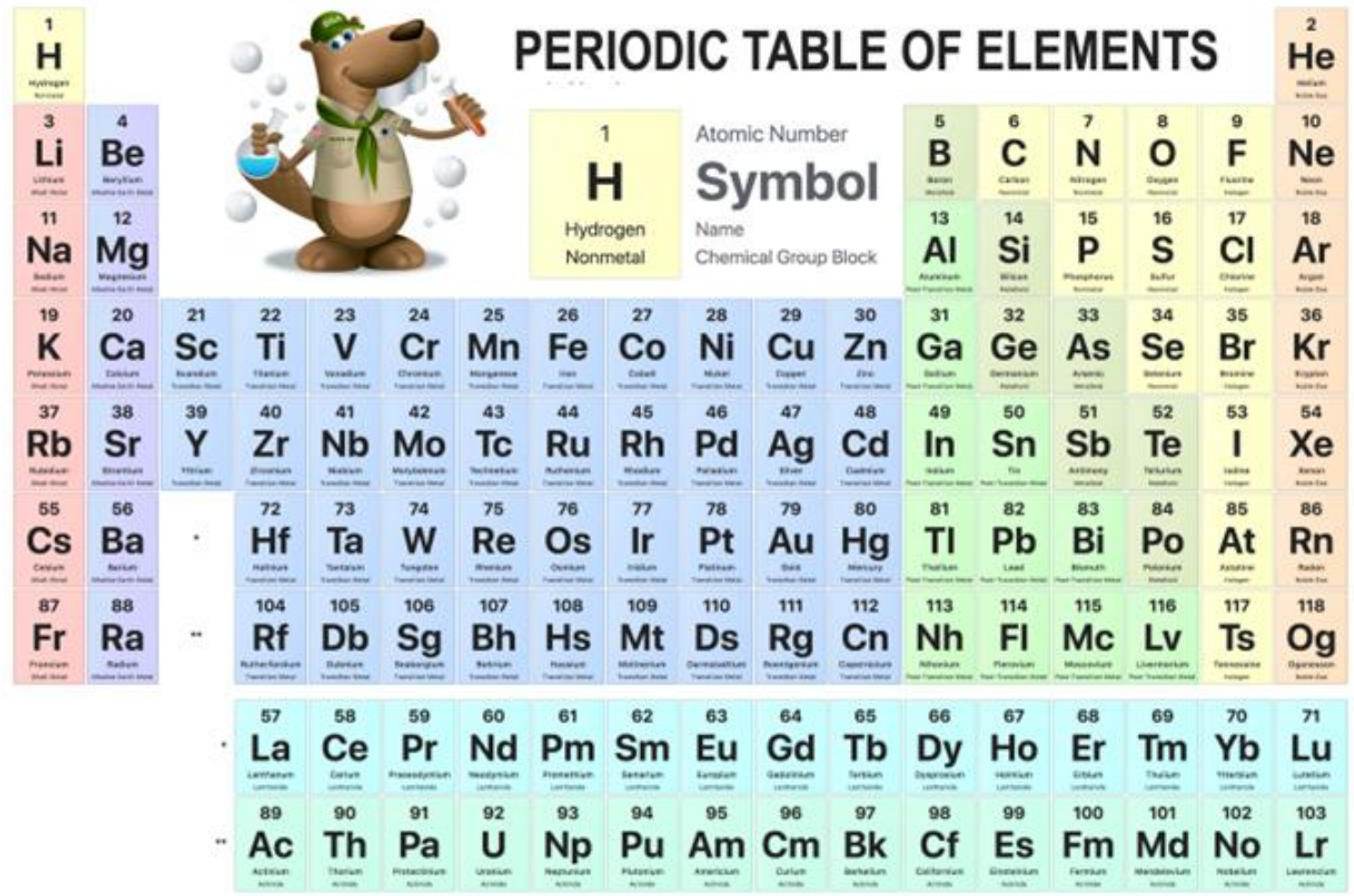
Gamma Ray:
X-Ray:
Ionization:
Radioactivity:
Radioisotope:
Stability:

REQUIREMENT 2b:	Choose an element from the periodic table. Construct 3-D models for the atoms of three isotopes of this element, showing neutrons, protons, and electrons. Write down the isotope notation for each model including the atomic and mass numbers.



Notes:

REQUIREMENT 2b:	In a separate model or diagram, explain or show how quarks make up protons and neutrons.
Notes:	

DO ONE OF THE FOLLOWING (3A or 3B) FOR REQUIREMENT 3

REQUIREMENT 3a:	Visit an accelerator, research lab, or university where scientists study the properties of the nucleus or nucleons.
Site Visited:	
Date and Time of Visit:	
Notes:	

REQUIREMENT 3b:	List three particle accelerators and describe several experiments that each accelerator performs, including basic science and practical applications.

PARTICLE ACCELERATOR #1:

Name and Location:

Experiments:

PARTICLE ACCELERATOR #2:

Name and Location:

Experiments:

PARTICLE ACCELERATOR #3:
Name and Location:
Experiments:

REQUIREMENT 3:	Discuss modern particle physics with your counselor.
Notes:	

DO TWO OF THE FOLLOWING (4A, 4B, or 4C) FOR REQUIREMENT 4

REQUIREMENT 4a:	Build an electroscope. Show how it works. Place a radiation source inside and explain the effect it causes.

No workbook entry is required for this requirement component.

This requirement must be reviewed with your merit badge counselor.

BE PREPARED!

REQUIREMENT 4b:	Make a cloud chamber. Show how it can be used to see the tracks caused by radiation. Explain what is happening.

No workbook entry is required for this requirement component.

This requirement must be reviewed with your merit badge counselor.

BE PREPARED!

REQUIREMENT 4c:	Perform an experiment demonstrating half-life. Discuss decay chains.

No workbook entry is required for this requirement component.

This requirement must be reviewed with your merit badge counselor.

BE PREPARED!

REQUIREMENT 4:	Make any notes for your selected Requirement 4 component below.

Notes:

DO ONE OF THE FOLLOWING (5A, 5B, or 5C) FOR REQUIREMENT 5

REQUIREMENT 5a:	Using a radiation survey meter and a radioactive source, show how the counts per minute change as the source gets closer to or farther from the radiation detector. Place three different materials between the source and the detector, then explain any differences in the measurements per minute.

No workbook entry is required for this requirement component.

This requirement must be reviewed with your merit badge counselor.

BE PREPARED!

REQUIREMENT 5a:	Explain how time, distance, and shielding can reduce an individual's radiation dose.

Notes:

REQUIREMENT 5b:	Describe how radon is detected in homes.

Notes:

REQUIREMENT 5b:	Discuss the steps taken for the long-term and short-term test methods, tell how to interpret the results, and explain when each type of test should be used.

LONG-TERM TEST METHOD:

Steps:

Interpretation of Results:

When this test should be used:

SHORT-TERM TEST METHOD:
Steps:
Interpretation of Results:
When this test should be used:

REQUIREMENT 5b:	Explain the health concern related to radon gas.

Notes:

REQUIREMENT 5b:	Tell what steps can be taken to reduce radon in buildings.

Notes:

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REQUIREMENT 5c:	Visit a place where X-rays are used. Draw a floor plan of this room. Show where the unit, the unit operator, and the patient would be when the X-ray unit is operated.
Site Visited:	
Date and Time of Visit:	

REQUIREMENT 5c:	Explain the precautions taken and the importance of those precautions.

Notes:

REQUIREMENT 5:	Discuss with your counselor the principles of radiation safety.

Notes:

DO ONE OF THE FOLLOWING (6A or 6B) FOR REQUIREMENT 6

REQUIREMENT 6a:	Make a drawing showing how nuclear fission happens.

Notes:

REQUIREMENT 6a:	Observe a mousetrap reactor (setup by an adult) and use it to explain how a chain reaction could be started.

No workbook entry is required for this part of the requirement component.

This requirement must be reviewed with your merit badge counselor during the class.

REQUIREMENT 6a:	Explain how a chain reaction could be stopped or controlled in a nuclear reactor.

Notes:

REQUIREMENT 6a:	Explain what is meant by a “critical mass.”

Notes:

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REQUIREMENT 6b:	Visit a local nuclear power plant or nuclear reactor either in person or online (with your parent's permission). Learn how a reactor works and how the plant generates electricity.

In-Person or Online Site Visit Name:

Address of Site Visited:

Parent's Name _____ Phone _____

Parent's Signature _____ Date _____

☐ *permission*

How the plant works:

How the plant generates electricity:

REQUIREMENT 6b:	Find out what percentage of electricity in the United States is generated by nuclear power plants, by coal, and by gas.

Notes:

REQUIREMENT 6:	Discuss with your counselor how nuclear energy is used to produce electricity.

Notes:

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REQUIREMENT 7:	Give an example of each of the following in relation to how energy from an atom can be used: nuclear medicine, environmental applications, industrial applications, space exploration, and radiation therapy. For each example, explain the application and its significance to nuclear science.

NUCLEAR MEDICINE:

How energy from an atom can be used in:

Applications:

Significance to Nuclear Science:

ENVIRONMENTAL APPLICATIONS:

How energy from an atom can be used in:

Applications:

Significance to Nuclear Science:

INDUSTRIAL APPLICATIONS:

How energy from an atom can be used in:

Applications:
Significance to Nuclear Science:
SPACE EXPLORATION:
How energy from an atom can be used in:
Applications:
Significance to Nuclear Science:
RADIATION THERAPY:
How energy from an atom can be used in:
Applications:
Significance to Nuclear Science:

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REQUIREMENT 8:	Find out about three career opportunities in nuclear science that interest you.
Career Opportunity #1:	
Career Opportunity #2:	
Career Opportunity #3:	
REQUIREMENT 8:	Pick one and find out the education, training, and experience required for this profession and discuss this with your counselor.
Selected Career Opportunity:	
Educational Requirements:	
Training Requirements:	
Experience Requirements:	
REQUIREMENT 8:	Tell why this profession interests you.
Notes:	