



NUCLEAR SCIENCE

The 2012 Spring PowWow

Official Merit Badge Worksheet

Scout's Name

Instructor's Name

Scout's Address

City

State

Zip

Instructions

- 1) The Scout is to review the merit badge book before the first week of the PowWow.
- 2) Bring this worksheet, paper, and pen or pencil each week.
- 3) **Bring a Merit Badge blue card with you on the second week.**

Requirement Instructions*

- 1) Requirement 1, 3, 7, and 8 should be covered and should be passed off during the two sessions of the PowWow.
- 2) Requirements 2, 5, and 6 should be started during the first session of the PowWow, but must be completed as **homework between the two sessions.**
- 3) Requirement 4 must be completed as **homework** before or in the time between the two sessions of the PowWow.

***Due to possible time constraints at the PowWow, certain requirements that were originally planned to be completed in class may need to be completed as homework. Please LISTEN to ALL INSTRUCTIONS in class to be aware of any changes.**

Requirement 1

Initial

Do the following:

a. Tell what radiation is.

b. Describe the hazards of radiation to humans,

the environment,

and wildlife.

Explain the difference between radiation exposure and contamination.

In your explanation, discuss the nature and magnitude of radiation risks to humans from nuclear power,

medical radiation,

and background radiation including radon.

Explain the ALARA principle and measures required by law to minimize these risks.

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

Tell why and how people must use radiation or radioactive materials carefully.

Requirement 2

Do the following:

a. Tell the meaning of the following:
atom,

nucleus,

proton,

Initial

neutron,

electron,

quark,

isotope;

alpha particle,

beta particle,

gamma ray,

X-ray;

ionization,

radioactivity,

and radioisotope

b. 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. Use the three models to explain the difference between atomic number and mass number and the difference between the quark structure of a neutron and a proton.

Requirement 3

Initial

Do ONE of the following; then discuss modern particle physics with your counselor:

a. Visit an accelerator (research lab) or university where people study the properties of the nucleus or nucleons.

b. Name three particle accelerators and describe several experiments that each accelerator performs.

then discuss modern particle physics with your counselor:

Requirement 4

Initial

Do TWO of the following;

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

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

c. Obtain a sample of irradiated and non-irradiated foods. Prepare the two foods and compare their taste and texture. Store the leftovers in separate containers and under the same conditions. For a period of 14 days, observe their rate of decomposition or spoilage, and describe the differences you see on days 5, 10, and 14.

5 days

10 days

14 days

d. Visit a place where radioisotopes are being used. Using a drawing, explain how and why they are used. Then discuss with your counselor the different kinds of radiation and how they can be used:

Requirement 5**Initial**

Do ONE of the following;

a. 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.

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

b. Describe how radon is detected in homes.

Discuss the steps taken for the long-term and short-term test methods,

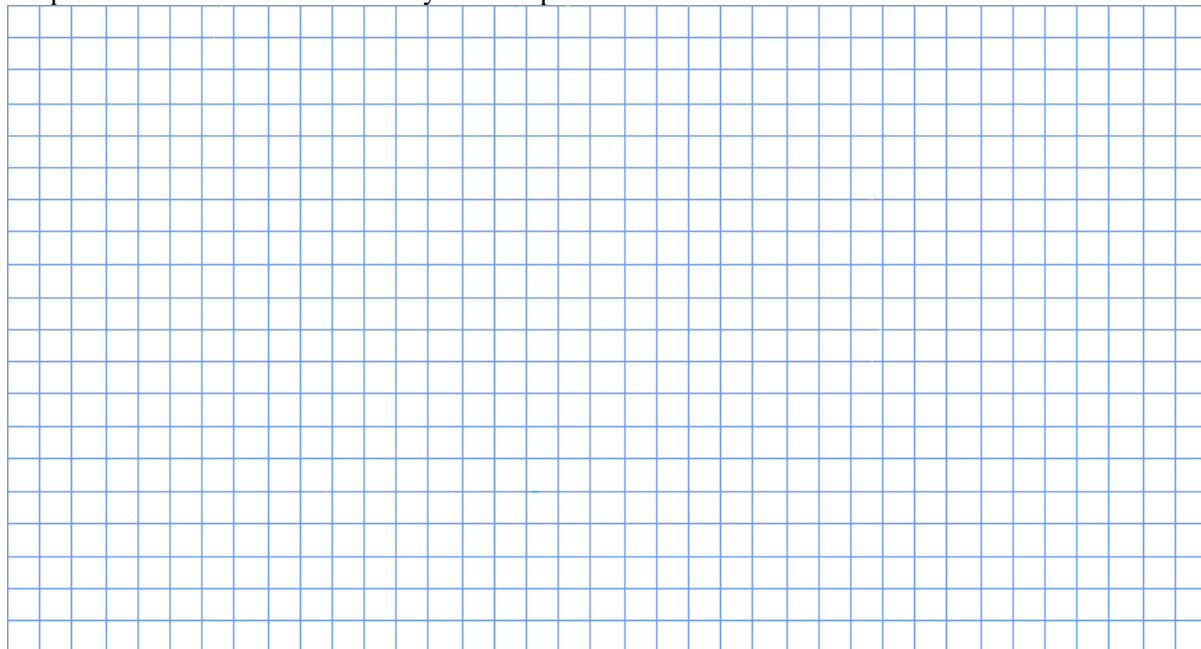
tell how to interpret the results,

and explain when each type of test should be used.

Explain the health concern related to radon gas

and tell what steps can be taken to reduce radon in buildings.

c. 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.



Explain the precautions taken and the importance of those precautions.

then discuss with your counselor the principles of radiation safety:

Requirement 6

Do ONE of the following:

- a. Make a drawing showing how nuclear fission happens, labeling all details.

Initial

Draw another picture showing how a chain reaction could be started and how it could be stopped.

Explain what is meant by a “critical mass.”

b. Build a model of a nuclear reactor. Show the fuel, control rods, shielding, moderator, and cooling material. Explain how a reactor could be used to change nuclear energy into electrical energy or make things radioactive.

c. Find out how many nuclear power plants exist in the United States. Locate the one nearest your home. Find out what percentage of electricity in the United States is generated by nuclear power plants, by coal, and by gas. Then discuss with your counselor how nuclear energy is used to produce electricity:

Requirement 7

Initial

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,

environmental applications,

industrial applications,

space exploration,

and radiation therapy.

Requirement 8

Initial

Find out about three career opportunities in nuclear science that interest you.

1.

2.

3.

Pick one and find out the education,

training,

and experience required for this profession.

Discuss this with your counselor, and explain why this profession might interest you.

Merit badge worksheets will not be accepted at the Council Office in place of the official Merit Badge Application Card. Those who do not complete all the requirements should take their partially completed merit badge worksheet and their official application card to their local merit badge counselors for completion.