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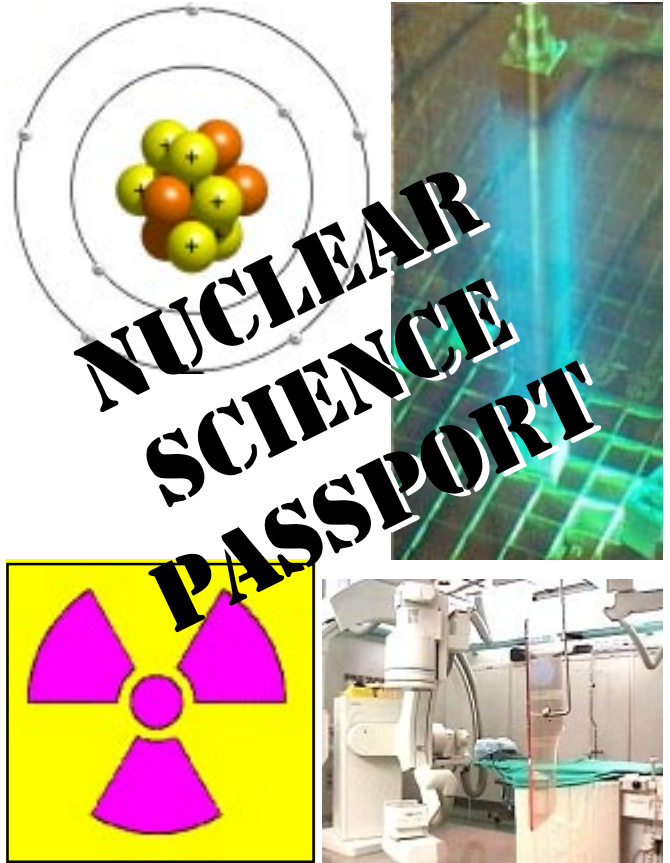
**NUCLEAR  
SCIENCE  
PASSPORT**

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**NUCLEAR  
SCIENCE  
PASSPORT**

**EFFECTS & HAZARDS (1)**

a. Describe biological effects and hazards of radiation to:  
humankind \_\_\_\_\_

the environment \_\_\_\_\_

wildlife \_\_\_\_\_

Explain the difference between **deterministic** and **stochastic** effects. (In your explanation, discuss the nature and magnitude of radiation risks to humans from nuclear power, medical radiation & background radiation.)

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**CAREERS (7)**

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

Pick **ONE** (circle your choice above). For this profession, what is required for each of the following?

education \_\_\_\_\_

training \_\_\_\_\_

experience \_\_\_\_\_

Tell why this profession interests you.

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Name **THREE** particle accelerators in the United States and describe the type of experiments each accelerator is designed to perform.



**accelerator 1**

experiment \_\_\_\_\_

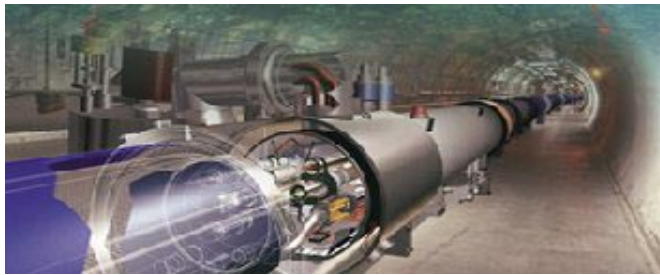
**accelerator 2**

experiment \_\_\_\_\_

**accelerator 3**

experiment \_\_\_\_\_

Name **THREE** particle accelerators in the United States and describe the type of experiments each accelerator is designed to perform.



**accelerator 1**

experiment \_\_\_\_\_

**accelerator 2**

experiment \_\_\_\_\_

**accelerator 3**

experiment \_\_\_\_\_

Explain measures required by law to minimize these risks.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



b. Describe the radiation hazard symbol.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain where it should be used. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain measures required by law to minimize these risks.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



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**DEFINITIONS (2)**

□ Tell the meaning of the following:

ALARA

alpha particle \_\_\_\_\_

atom \_\_\_\_\_

background radiation \_\_\_\_\_

beta particle \_\_\_\_\_

contamination \_\_\_\_\_

curie and becquerel \_\_\_\_\_

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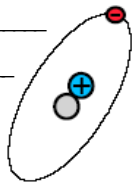
atom \_\_\_\_\_

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contamination \_\_\_\_\_

curie and becquerel \_\_\_\_\_



□ c. Identify **THREE** particle accelerators in the United States. For each accelerator, describe three experiments that have been done or are in progress.

**accelerator 1**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

**accelerator 2**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

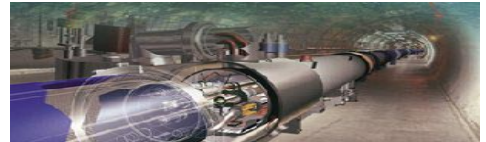
**accelerator 3**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

□ c. Identify three particle accelerators in the United States. For each accelerator, describe three experiments that have been done or are in progress.

**accelerator 1**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

**accelerator 2**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

**accelerator 3**

experiment 1 \_\_\_\_\_

experiment 2 \_\_\_\_\_

experiment 3 \_\_\_\_\_

□ b. How many nuclear power plants exist in the United States?

Locate and list the one nearest *your* home:

What percentage of electricity in the U.S. is generated by:  
nuclear power plants ..... %  
by coal ..... %  
by gas ..... %



gamma ray \_\_\_\_\_

half-life \_\_\_\_\_

ionization \_\_\_\_\_

quark \_\_\_\_\_

isotope \_\_\_\_\_



neutron \_\_\_\_\_

nuclear energy \_\_\_\_\_

nuclear reactor \_\_\_\_\_

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nuclear reactor \_\_\_\_\_

particle accelerator \_\_\_\_\_

rad and gray \_\_\_\_\_

radiation \_\_\_\_\_

radioactivity \_\_\_\_\_

radon \_\_\_\_\_

rem and sievert \_\_\_\_\_

X-ray \_\_\_\_\_



**industrial applications**

application \_\_\_\_\_

significance \_\_\_\_\_

**space exploration**

application \_\_\_\_\_

significance \_\_\_\_\_

**radiation therapy**

application \_\_\_\_\_

significance \_\_\_\_\_



particle accelerator \_\_\_\_\_

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**radiation therapy**

application \_\_\_\_\_

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### NUCLEAR ENERGY'S USE (6)

Do **ONE** of the following:

a. Give an example of each of the following in relation to how energy from an atom can be used, its application and its significance to nuclear science:

**nuclear science**

application \_\_\_\_\_

significance \_\_\_\_\_

**nuclear medicine**

application \_\_\_\_\_

significance \_\_\_\_\_

**environmental applications**

application \_\_\_\_\_

significance \_\_\_\_\_

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application \_\_\_\_\_

significance \_\_\_\_\_

**environmental applications**

application \_\_\_\_\_

significance \_\_\_\_\_

### IMPORTANT INDIVIDUALS (3)

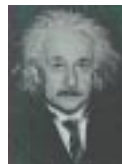
Choose **FIVE** individuals important to the field of atomic energy and nuclear science and explain each person's contribution.



FARADAY



HEISENBERG



EINSTEIN



CURIE



BOHR

Name \_\_\_\_\_

Their Contribution \_\_\_\_\_

Name \_\_\_\_\_

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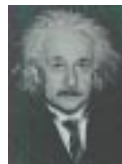
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Name _____
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_____
_____

*“The only reason for time is so that everything doesn’t happen at once.”*

- Albert Einstein

- e.** Describe how radon is detected in homes. Discuss the steps taken for the long-term and short-term test methods, 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.
- f.** Visit a place where X-ray is used. Draw a floor plan of the room in which it is used. Show where the unit, the unit operator, and the patient would be when X-ray is used. Explain the precautions taken when X-ray is used and the importance of those precautions.
- g.** Make a cloud chamber. Show how it can be used to see tracks caused by radiation. Explain what is happening.
- h.** Visit a place where radioisotopes are being used. Using a drawing, explain how and why they are used.
- i.** Obtain samples of irradiated seeds. Plant them. Plant a group of non-irradiated seeds of the same kind. Grow both groups. List any differences you observe during a 30-day period. Discuss with your counselor what irradiation does to seeds.
- j.** Visit an accelerator (research lab) or university where people study the properties of the nucleus. After your visit, discuss what you have learned with your counselor.

Name _____
Their Contribution _____
_____
_____

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## PROJECTS (5)

Do any **THREE** of the following:

- ❑ a. Build an electroscope. Show how it works. Place a radiation source inside & explain any difference seen.
- ❑ b. Build a model of a reactor. Show the fuel, control rods, shielding, moderator, and any cooling material. Explain how a reactor could be used to change nuclear energy into electrical energy or make things radioactive.
- ❑ c. Using a radiation survey meter and a radioactive source, show how the measurements per minute change as the source gets closer to or farther from the radiation detector. Place three different kinds of materials between the source and the detector, then explain any differences in the measurements per minute. Explain how time, distance, and shielding can reduce the radiation dose.
- ❑ d. 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.

## PROJECTS (5)

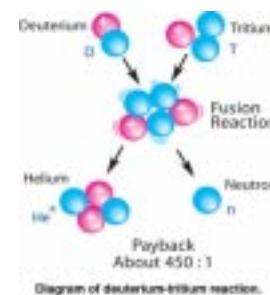
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## 3-D MODEL (4)

Periodic table showing elements grouped by color: Hydrogen (1), Helium (2), Lithium (3), Beryllium (4), Boron (5), Carbon (6), Nitrogen (7), Oxygen (8), Fluorine (9), Neon (10), Sodium (11), Magnesium (12), Aluminum (13), Silicon (14), Phosphorus (15), Sulfur (16), Chlorine (17), Argon (18), Potassium (19), Calcium (20), Scandium (21), Titanium (22), Vanadium (23), Chromium (24), Manganese (25), Iron (26), Cobalt (27), Nickel (28), Copper (29), Zinc (30), Gallium (31), Germanium (32), Arsenic (33), Selenium (34), Bromine (35), Krypton (36), Rubidium (37), Strontium (38), Yttrium (39), Zirconium (40), Niobium (41), Molybdenum (42), Technetium (43), Ruthenium (44), Rhodium (45), Palladium (46), Silver (47), Cadmium (48), Indium (49), Tin (50), Antimony (51), Tellurium (52), Iodine (53), Xenon (54), Francium (87), Radium (88), Actinides (89-103), Lanthanides (57-71).

- ❑ 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.

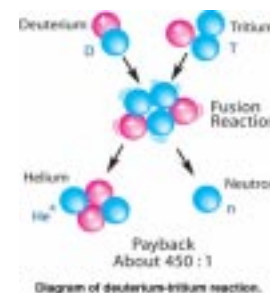


[http://www.pppl.gov/fusion\\_basics/pages/fusion\\_reactions.html](http://www.pppl.gov/fusion_basics/pages/fusion_reactions.html)

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

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

b. What is meant by a critical mass? \_\_\_\_\_

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