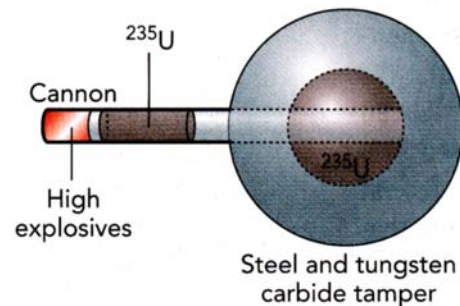


Physics 106 - How Things Work II - Spring 2008
Problem Set #6 (first of two pages)

1. What can you say about two different isotopes of the same element?
 - A. They have the same mass number but different atomic numbers.
 - B. They have the same atomic number but different mass numbers.
 - C. They have the same mass numbers and the same atomic numbers.
 - D. They can have different mass numbers and different atomic numbers.
2. How would you describe the following reaction: ${}^3\text{H} + {}^2\text{H} \longrightarrow {}^4\text{He} + \text{n}$
 - A. Fission.
 - B. Alpha decay.
 - C. Beta decay.
 - D. Fusion.

3. The first atomic bomb used in warfare was called "Little Boy" and was based on the use of ${}^{235}\text{U}$. Your book describes the functioning of the bomb as involving the firing of a more-or-less cylindrical slug of uranium into a sphere of uranium into which the slug fit. How did this cause the bomb to explode?



- A. The heat energy released by the mating of the two pieces was sufficient to cause the bomb to detonate.
 - B. The heat energy released by the mating of the two pieces plus a neutron trigger caused the bomb to detonate.
 - C. The mating of the two pieces created a critical mass of ${}^{235}\text{U}$ which together with a neutron trigger was sufficient to cause the bomb to detonate.
 - D. The heat energy released by the mating of the two pieces together with the creation of a critical mass of ${}^{235}\text{U}$ caused the bomb to detonate.
4. The U.S. has many nuclear weapons with yields in the range of 1 MT. How does this yield compare with the yield of Fat Man?
 - A. About the same.
 - B. About ten times larger.
 - C. About fifty times larger.
 - D. About 500 times larger.
 5. How is plutonium produced?
 - A. It is bred by irradiating ${}^{238}\text{U}$ in a nuclear reactor with neutrons.
 - B. It is bred by irradiating ${}^{238}\text{U}$ in a particle accelerator with neutrons.
 - C. It is isotopically separated in huge facilities using ultra-centrifuges.
 - D. It is found in minute quantities in natural minerals and is chemically separated.

Physics 106 - How Things Work II - Spring 2008
Problem Set #6 (the second of two pages)

6. At Hiroshima, which of the following effects of Little Boy caused the least number of initial deaths (that is, not counting deaths that came in the following weeks).
- A. Fallout.
 - B. Blast.
 - C. Heat.
 - D. Prompt nuclear radiation.
7. Natural uranium is only about 0.7% ^{235}U , and the rest is ^{238}U . The ^{235}U is the only isotope of uranium that is capable of sustaining a chain reaction. It is estimated that the world's existing resources of ^{235}U are capable of supplying the entire world's energy needs for something like 20 years. If one were to breed the ^{238}U into usable fuel, how many years could the world's supply of uranium supply all of the world's energy needs?
- A. About 1000 years.
 - B. About 100 years.
 - C. About 10,000 years.
 - D. About 500 years.
8. One of the drawbacks of a CT scan is that it:
- A. It is only sensitive to dense objects such as bone.
 - B. It exposes you to potentially damaging radiation from X-rays.
 - C. It exposes you to potentially damaging radiation from microwaves.
 - D. It exposes you to potentially damaging radiation from radio waves.
9. Magnetic resonance imaging involves:
- A. Placing the patient in a large magnetic field.
 - B. Irradiating the patient with bursts of radio waves.
 - C. The application of magnetic field gradients both while irradiating the patient and while "listening" for the small radio signals that are then emitted by the patient.
 - D. All of the above.