

Please read but **do not** discuss with peers. You may write your answer/ideas at the bottom of the page.

Question 1

Based on the reading from the textbook, and the two excerpts from the news (see below), please explain the science concept behind the relevance of the nuclear centrifuges. Please refrain from sharing your opinions about the conflict itself (that can be done some other time). We are solely interested in your scientific interpretation.

Iran Has Centrifuge Capacity for Nuclear Arms, Report Says

By WILLIAM J. BROAD and DAVID E. SANGER

The New York Times

Published: June 5, 2009

“A week before Iran’s presidential election, atomic inspectors reported Friday that the country has sped up its production of nuclear fuel and increased its number of installed centrifuges to 7,200 — more than enough, weapon experts said, to make fuel for up to two nuclear weapons a year, if the country decided to use its facilities for that purpose.”

Computer worm aimed at Iran's centrifuges?

Denver Post Wire Report

Posted: 11/19/2010 01:00:00 AM MST

“Experts dissecting the computer worm suspected of being aimed at Iran's nuclear program have determined it was precisely calibrated in a way that could send nuclear centrifuges wildly out of control. Their conclusion, while not definitive, begins to clear some of the fog around the Stuxnet worm, a malicious program detected this year on computers, primarily in Iran but also in India, Indonesia and other countries.”

Textbook reading:

“Scientists quickly realized that a sample rich in U-235 could undergo a **chain reaction** in which neutrons produced by the fission of one uranium nucleus would induce fission in other uranium nuclei. This self-amplifying reaction is capable of producing an enormous amount of energy—and atomic bomb. However, to make a bomb, a **critical mass** of U-235—enough U-235 to produce a self-sustaining reaction—is necessary.”

Please read but **do not** discuss with peers. You may write your answers/ideas at the bottom of the page.

The alpha particle is the most massive of all particles emitted by radioactive nuclei. Therefore, alpha radiation has the most potential to interact with other molecules and eventually cause damage. Highly energetic radiation interacts with molecules by ionizing them. When radiation ionizes molecules within the cells of living organisms, those molecules may undergo damaging chemical reactions, and the cells can die or begin to reproduce abnormally. The ability of radiation to ionize molecules and atoms is known as the ionizing power. How do you think the high mass of alpha radiation is related to its ionizing power being the highest of all types of radioactivity?

In order for radiation to damage important molecules within living cells, it must penetrate into the cells. The ability to penetrate matter is called the penetrating power. It has been observed that a low-level alpha emitter that remains outside the body is relatively safe compared, for instance, to gamma radiation. How would you explain the difference in penetrating power between alpha and gamma radiation? Why do you think the ionizing power and the penetrating power are inversely related?