1. Why do nuclei need neutrons?

(A) To prevent protons from repelling each other out of the nucleus.
(B) To prevent electrons from entering the nucleus.
(C) To add additional energy to the nucleus.
(D) To push protons to the surface of the nucleus for greater attraction to the electrons circling the nucleus.

The correct answer is A. Without neutrons, protons, being positive and so close together, would repel each other out of the nucleus.

2. What statement about neutrons is true?

(A) Neutrons are made from two protons minus an electron.
(B) Neutrons are about half the size of a proton.
(C) Neutrons consist of a proton and electron combined.
(D) Neutrons cluster toward the center of the nucleus.

The correct answer is C. Because neutrons are made from a proton and electron, neutrons have no electrical charge. Because electrons weigh so little, neutrons (a proton and an electron combined) are almost exactly the same size and weight as a proton. Neutrons are distributed throughout the nucleus.

3. One way that neutrons stabilize the nucleus is by _____.

(A) preventing electrons from entering the nucleus
(B) having features of both a proton and an electron
(C) increasing the weight of a nucleus
(D) nudging protons apart

The correct answer is D. Neutrons wiggle in between protons and push them apart slightly so that they do not repel each other as much.

4. Another way neutrons stabilize the nucleus is by _____.

(A) exerting a strong force
(B) pushing protons closer together
(C) neutralizing the force of repulsion between protons
(D) weakening the positive charge on protons

The correct answer is A. Neutrons, like protons, possess the strong force that attracts protons to neutrons if the two are almost touching.

5. The strong force _____.

(A) works over a very short distance
(B) prevents neutrons from ejecting an electron and becoming a proton again
(C) prevents additional energy from entering the nucleus
(D) is weaker than the force of electrical attraction

The correct answer is A. The strong force between two protons or between a neutron and a proton only works to pull the two together when two protons or a neutron and a proton are extremely close to each other.

6. Two isotopes of the same element _____.

(A) weigh the same
(B) have different electrical charges
(C) have the same number of neutrons
(D) have the same number of protons

The correct answer is D. The number of protons in an atom's nucleus determine the element, so all atoms of an element, regardless of the number of neutrons there are in its nucleus, have the same number of protons. Different isotopes have different numbers of neutrons, so different isotopes weigh differently. Since neutrons are electrically neutral, the number of neutrons in the nucleus has no effect on the electrical charge of the atom.

7. The atomic weight of an element listed in the periodic table _____.

(A) reflects the weight of the most common isotope of that element in nature
(B) reflects the weight of the atom with an average number of neutrons for that element
(C) reflects the average weight of an atom of that element found in nature
(D) reflects the average weight of an atom of that element found in the sample examined

The correct answer is C. Each element's atomic weight in the periodic table is determined by populating a sample of element according to the percentage of each isotope in nature. That way, more weight is given to those isotopes with greater frequency. The "weighted average" of the sample is the atomic weight of that element in the periodic table. Because the atomic weight takes into consideration all the possible isotopes for that element, the atomic weight is never exactly a whole number.

8. The atomic weight, rounded off to the nearest whole number, minus the atomic number equals what?

(A) The number of protons in the nucleus of that element.
(B) The number of neutrons in the nucleus of that element.
(C) The number of electrons in the nucleus of that element.
(D) The number of protons and neutrons in the nucleus of that element.

The correct answer is B. Virtually all the weight of an atom is in its protons and neutrons, very little in its electrons, so the atomic weight of an element is the weight of its protons and neutrons. The atomic number of an element, which is determined by its position in the periodic table, is the number of protons in the nucleus. Atomic weight minus atomic number, then, is the number of neutrons in the nucleus.

9. Why does radioactivity only occur in large atoms, atoms larger than iron?

(A) Radioactivity occurs in large atoms because large nuclei have so many protons that no matter how many neutrons the nucleus has, the repulsive force of all those protons makes the nucleus unstable.
(B) Radioactivity only occurs in large atoms because large nuclei have so many neutrons that the nucleus becomes unstable.
(C) Radioactivity only occurs in large atoms because with so many protons and neutrons, all of the individual strong forces destabilize the nucleus.
(D) Radioactivity only occurs in large atoms because large nuclei exert such a strong attraction for the electrons circling the nucleus that periodically an electron enters the nucleus and must be ejected from the nucleus.

The correct answer is A. The electrical force of repulsion between protons simply becomes too great in nuclei larger than iron, even with neutrons. Nuclei respond to the excess forces of repulsion by ejecting various particles and rays to reduce the energy level in the nucleus.