

1. Which of the following statements about transistors is (or are) true?

1. Transistors amplify the current leaving the base layer.
2. Electrons in transistors move from the P layer to the N layer.
3. Removing the base layer changes a transistor into a diode.

- (A) Only statement 1
- (B) Only statement 2
- (C) Only statement 3
- (D) Statements 1 and 3
- (E) Statements 2 and 3

2. In a transistor, free-floating electrons in the emitter layer of the N semiconductor fall into holes within the P layer. Those holes are empty suborbitals of atoms within the P layer. When electrons fall, they accelerate and give off electromagnetic radiation.

If the electrons fall far enough, the photons have enough energy to produce visible light. Which of the following uses this mechanism of N and P semiconductors to produce light?

- (A) laser light
- (B) incandescent light
- (C) light emitting diode
- (D) fluorescent light
- (E) arc lights

3. The half-life of carbon 14 is 5730 years. 1 gram of carbon from a living plant undergoes 500 counts per minute. A 1 gram sample of carbon from a piece of dead wood undergoes 125 counts per minute. Approximately how old is the piece of dead wood?

- (A) 1400 years
- (B) 2800 years
- (C) 5700 years
- (D) 12,000 years
- (E) 24,000 years

4. A radioactive isotope initially manifests 80 clicks per minute, but after 9 days is down to 10 clicks per minute. What is its half-life?

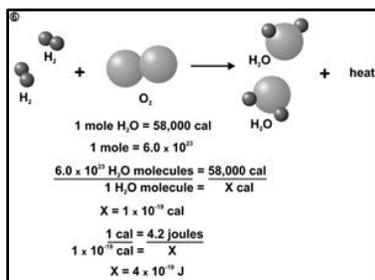
- (A) 1 day
- (B) 3 days
- (C) 5 days
- (D) 7 days
- (E) 9 days

5. If the mass of a helium nucleus is 0.03037 atomic mass units, what is the binding energy of a helium nucleus? 1 atomic mass unit (amu) is 1.66×10^{-27} kg.

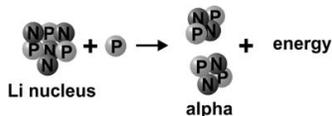
- (A) 1.83×10^{-13} J
- (B) 1.83×10^{-12} J
- (C) 1.65×10^{-13} J
- (D) 1.65×10^{-12} J
- (E) 1.65×10^{-11} J

Introduction to Question 6

In the chemical reaction where hydrogen gas is burned to form water, 2 hydrogen molecules combine with a single oxygen molecule to form 2 molecules of water.



6. The mass of a lithium nucleus is 11.65034×10^{-27} kg, and the mass of a proton is 1.67263×10^{-27} kg. The mass of an alpha particle is 6.64466×10^{-27} kg.



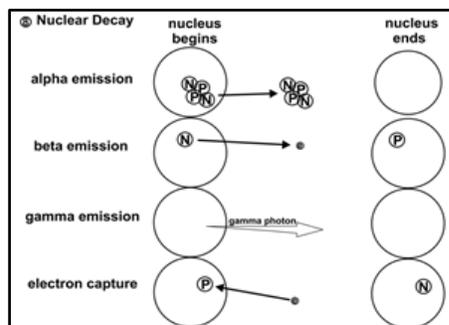
- (A) 1000 times greater
- (B) 100,000 times greater
- (C) 1,000,000 times greater
- (D) 10,000,000 times greater
- (E) 1000,000,000 times greater

7. To a person standing still, what is the length of a 1.00 meter pipe when it speeds up to six-tenths the speed of light?

- (A) 0.8 m
- (B) 0.9 m
- (C) 0.64 m
- (D) 0.36 m
- (E) 0.6 m

Intro to Question 8

Four common methods of nuclear decay include alpha emission, beta emission, gamma emission, and electron capture.



In alpha emission, the nucleus releases an alpha particle consisting of 2 protons and 2 neutrons and ends up 4 atomic mass units lighter.

In beta emission, a neutron in the nucleus releases an electron and turns into a proton.

In gamma emission, the nucleus releases a gamma photon with no change in the number of protons or neutrons.

In electron capture, a proton captures an electron and becomes a neutron.

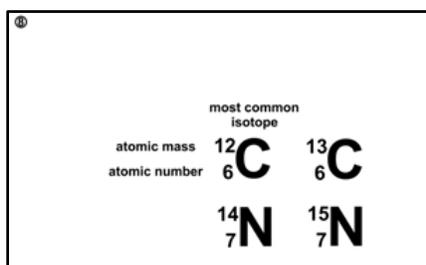
Elements in the periodic table are symbolized by letters and two numbers. The bottom number, called the atomic number, refers to the number of protons in the nucleus. The atomic number determines the element. A different atomic number means a different element.

Test, Lesson 15 – The Nucleus

Adding the number of neutrons in the nucleus to the bottom number gives the upper number, called the atomic mass.

- (A) A, A, C, D, B
- (B) B, A, B, D, C
- (C) B, D, C, A, D
- (D) A, A, B, D, C
- (E) A, D, C, A, C

Changing the number of protons in the nucleus changes the element. Changing the number of neutrons changes the isotope of that element.



8. Match the process of nuclear decay.

- A= alpha decay
- B= beta emission
- C= gamma emission
- D= electron capture

