

Name _____ Date _____ Class _____

CHAPTER 25 STUDY GUIDE FOR CONTENT MASTERY

Section 25.3 Transmutation

In your textbook, read about the process of induced nuclear transmutation.

For each statement below, write *true* or *false*.

1. Transmutation is the conversion of an atom of one element to an atom of another element. true
2. All nuclear reactions involve some type of nuclear transmutation. false
3. Scientists induce transmutations by bombarding stable nuclei with high-energy alpha, beta, or gamma radiation. true
4. The first induced nuclear transmutation was carried out by Marie and Pierre Curie in 1897. false
5. Most induced transmutation reactions are produced in high-energy particle accelerators. true
6. Neptunium and plutonium were the first transuranium elements discovered. true
7. The nuclear formula for a neutron is n . false
8. The half-life of a radioisotope is the time it takes for that isotope to decay. false
9. A radioisotope that decays very rapidly has a short half-life. true
10. Radioisotopes with very long half-lives are seldom found in Earth's crust. false
11. Temperature is the only factor that affects the half-life of a radioisotope. false
12. Carbon dating is not used to measure the age of rocks because the half-life of carbon-14 is too short. true
13. After an organism dies, its ratio of carbon-14 to carbon-12 and carbon-13 increases. false
14. Scientists currently believe that all of the possible transuranium elements have been discovered. false
15. When an atom of $^{252}_{98}\text{Cf}$ is bombarded with protons, the products are $^{253}_{99}\text{Am}$ and neutrons. true
16. Mass number and atomic number are conserved in all nuclear reactions. true
17. The mass of a 25.0 g piece of $^{238}_{94}\text{Pu}$ (half-life: 2.4 hr) will be reduced to 3.1 g after 7.2 hr. true

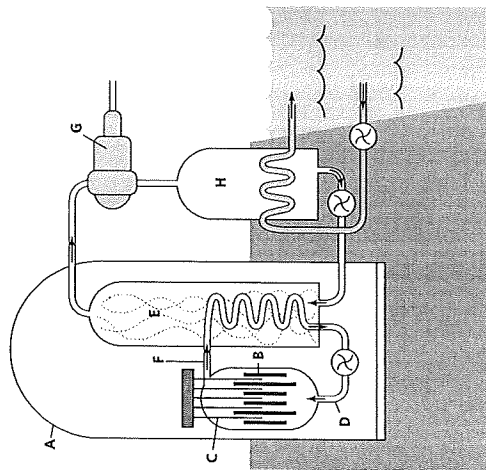
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Section 25.4 Fission and Fusion of Atomic Nuclei

In your textbook, read about the process of which electrical energy is produced in a nuclear power plant.

Use the following diagram to complete the passage.



In a nuclear power plant, energy is produced in the reactor core by fission reactions that occur in uranium-containing bars called (1) **fuel rods**. The uranium is found at location (2) **B** in the diagram. The rate at which the nuclear reaction takes place is controlled by other bars called (3) **control rods**. These bars of metal are found at location (4) **C**. One of the important safety factors in the power plant is a strong dome-shaped structure surrounding the reactor. The structure is labeled (5) **A** in this diagram and called (6) **the containment shell**.

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Section 25.4 continued

Heat produced by nuclear fission is carried away by (7) a coolant, which enters the core at point (8) D in the diagram. It then leaves the core at point (9) F.

Heat from the reactor core is used to boil water in the (10) steam generator, shown at (11) E in the diagram. Steam produced here is used to generate electricity at point (12) G in the diagram. The steam is then cooled at location (13) H by water from an outside source.

For each statement, write *true* or *false*.

- false 14. A nuclear reactor produces energy from fuel rods containing uranium-238.
false 15. The amount of energy produced for each kilogram of uranium is about the same as the amount of energy from a kilogram of coal.
true 16. The only elements that can be used as fuel in a nuclear power plant are those in which a chain reaction can occur.
true 17. If more than a critical mass is present in a sample, that sample is said to have supercritical mass.
true 18. Water is the most common coolant used in a nuclear reactor.
true 19. Nuclear power plants usually produce electricity.
false 20. The purpose of the control rods in a nuclear reactor is to reflect neutrons back into the core.
false 21. The production of energy in a nuclear reactor can be stopped by pulling out all control rods.
true 22. A breeder reactor produces more fuel than it uses.
false 23. The fission products produced in nuclear power plants are not radioactive.
true 24. An uncontrolled chain reaction led to the nuclear accident in Chernobyl, Ukraine.

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Section 25.5 Applications and Effects of Nuclear Reactions

In your textbook, read about the methods used to detect and measure radiation.

For each item in Column A, write the letter of the matching item in Column B.

Column A

- o 1. Worn by workers to monitor radiation exposure
j 2. Contains phosphors that detect radiation
d 3. Radiation energetic enough to break apart atoms
b 4. Uses a gas-filled metal tube to detect and measure radiation
n 5. A material that gives off light when struck by radiation
i 6. A method used to detect very small amounts of an element in a sample
k 7. A radioisotope used to indicate the presence of an element in a sample
f 8. Used to detect disorders of the thyroid gland
a 9. A procedure that uses positrons to detect many different medical disorders
l 10. This type of radiation easily penetrates human tissue.
m 11. Damage caused by radiation that affects a person, but not their offspring
h 12. Radiation damage that can affect chromosomes and offspring
e 13. A unit used to measure the amount of radiation absorbed by a body
g 14. A unit used to measure the amount of damage done to a body
c 15. The annual amount of radiation to which a person is normally exposed

Column B

- a. PET
b. Geiger counter
c. 100–300 mrem
d. ionizing radiation
e. rad
f. iodine-131
g. rem
h. genetic damage
i. neutron activation analysis
j. scintillation counter
k. radiotracer
l. gamma ray
m. somatic damage
n. phosphor
o. film badge