

Benefits And Risks Associated With Fission And Fusion Reactions

- 1 Which radioisotope requires long-term storage as the method of disposal, to protect living things from radiation exposure over time?
 - (1) Pu-239
 - (2) Fr-220
 - (3) Fe-53
 - (4) P-32

- 2 The ratio of the mass of U-238 to the mass of Pb-206 can be used to
 - (1) diagnose thyroid disorders
 - (2) diagnose kidney function
 - (3) date geological formations
 - (4) date once-living things

- 3 Which phrase describes a risk of using the radioisotope Co-60 in treating cancer?
 - (1) production of acid rain
 - (2) production of greenhouse gases
 - (3) increased biological exposure
 - (4) increased ozone depletion

- 4 Dating once-living organisms is an example of a beneficial use of
 - (1) redox reactions
 - (2) organic isomers
 - (3) radioactive isotopes
 - (4) neutralization reactions

- 5 The use of uranium-238 to determine the age of a geological formation is a beneficial use of
 - (1) nuclear fusion
 - (2) nuclear fission
 - (3) radioactive isomers
 - (4) radioactive isotopes

- 6 Which phrase describes a risk associated with producing energy in a nuclear power plant?
 - (1) depletion of atmospheric hydrogen (H₂)
 - (2) depletion of atmospheric carbon dioxide (CO₂)
 - (3) production of wastes needing long-term storage
 - (4) production of wastes that cool surrounding water supplies

- 7 Which radioisotope is used to determine the age of once-living organisms?
 - (1) carbon-14
 - (2) cobalt-60
 - (3) iodine-131
 - (4) uranium-238

- 8 Which radioisotope is used in dating geological formations?
 - (1) I-131
 - (2) U-238
 - (3) Ca-37
 - (4) Fr-220

- 9 One beneficial use of radioisotopes is
 - (1) detection of disease
 - (2) neutralization of an acid spill
 - (3) decreasing the dissolved O₂(g) level in seawater
 - (4) increasing the concentration of CO₂(g) in the atmosphere

- 10 The dating of geological formations is an example of a beneficial use of
 - (1) isomers
 - (2) electrolytes
 - (3) organic compounds
 - (4) radioactive nuclides

Base your answers to questions 11 on the information below.

Nuclear fission has been used to produce electricity. However, nuclear fusion for electricity production is still under development. The notations of some nuclides used in nuclear reactions are shown in the table below.

Some Nuclides Used in Nuclear Reactions

| Reaction | Nuclides |
|-----------------|---|
| nuclear fission | ${}_{92}^{233}\text{U}$, ${}_{92}^{235}\text{U}$ |
| nuclear fusion | ${}_{1}^1\text{H}$, ${}_{1}^3\text{H}$ |

- 11 State one potential benefit of using nuclear fusion instead of the current use of nuclear fission to produce electricity.

Base your answers to questions 12 on the information below.

Nuclear radiation is harmful to living cells, particularly to fast-growing cells, such as cancer cells and blood cells. An external beam of the radiation emitted from a radioisotope can be directed on a small area of a person to destroy cancer cells within the body.

Cobalt-60 is an artificially produced radioisotope that emits gamma rays and beta particles. One hospital keeps a 100.0-gram sample of cobalt-60 in an appropriate, secure storage container for future cancer treatment.

- 12 State one risk to human tissue associated with the use of radioisotopes to treat cancer.

Answer Keys

1 1

2 3

3 3

4 3

5 4

6 3

7 1

8 2

9 1

10 4

11 Allow 1 credit. Acceptable responses include, but are not limited to:

- Fusion produces more energy per gram of reactant.
- The fusion process produces less radioactive waste.
- The fusion reactant material is more readily available.

12 Allow 1 credit. Acceptable responses include, but are not limited to:

- Nuclear radiation is harmful to all living cells.
- Radioisotopes can cause gene mutations.
- Treatments can cause stomach problems, such as nausea.