

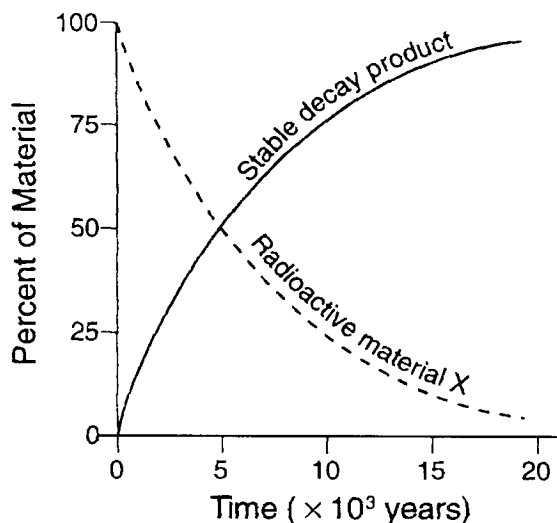
Name:

## Practice Nuclear Chemistry Test

- An alpha particle has the same composition as a
  - hydrogen nucleus
  - deuterium nucleus
  - beryllium nucleus
  - helium nucleus
- Which list of nuclear emissions is arranged in order from the *least* penetrating power to the greatest penetrating power?
  - alpha particle, beta particle, gamma ray
  - alpha particle, gamma ray, beta particle
  - gamma ray, beta particle, alpha particle
  - beta particle, alpha particle, gamma ray
- Which reaction is an example of natural transmutation?
  - ${}_{94}^{239}\text{Pu} \rightarrow {}_{92}^{235}\text{U} + {}_2^4\text{He}$
  - ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
  - ${}_{92}^{238}\text{U} + {}_0^1\text{n} \rightarrow {}_{94}^{239}\text{Pu} + 2 {}_{-1}^0\text{e}$
  - ${}_{94}^{239}\text{Pu} + {}_0^1\text{n} \rightarrow {}_{56}^{147}\text{Ba} + {}_{38}^{90}\text{Sr} + 3 {}_0^1\text{n}$
- Which equation represents positron decay?
  - ${}_{37}^{87}\text{Rb} \rightarrow {}_{-1}^0\text{e} + {}_{38}^{87}\text{Sr}$
  - ${}_{92}^{277}\text{U} \rightarrow {}_{90}^{223}\text{Th} + {}_2^4\text{He}$
  - ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
  - ${}_{6}^{11}\text{C} \rightarrow {}_{+1}^0\text{e} + {}_5^{11}\text{B}$
- Which two radioisotopes have the same decay mode?
  - ${}^{37}\text{Ca}$  and  ${}^{53}\text{Fe}$
  - ${}^{220}\text{Fr}$  and  ${}^{60}\text{Co}$
  - ${}^{37}\text{K}$  and  ${}^{42}\text{K}$
  - ${}^{99}\text{Tc}$  and  ${}^{19}\text{Ne}$
- Which nuclear equation represents beta decay?
  - ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
  - ${}_{92}^{238}\text{U} \rightarrow {}_{90}^{234}\text{Th} + {}_2^4\text{He}$
  - ${}_{6}^{14}\text{C} \rightarrow {}_7^{14}\text{N} + {}_{-1}^0\text{e}$
  - ${}_{18}^{37}\text{Ar} + {}_{-1}^0\text{e} \rightarrow {}_{17}^{37}\text{Cl}$
- Which nuclear decay emission consists of energy, only?
  - alpha particle
  - beta particle
  - gamma radiation
  - positron
- If  $\frac{1}{8}$  of an original sample of krypton-74 remains unchanged after 34.5 minutes, what is the half-life of krypton-74?
  - 11.5 min
  - 23.0 min
  - 34.5 min
  - 46.0 min
- Which radioisotope undergoes beta decay and has a half-life of less than 1 minute?
  - Fr-220
  - K-42
  - N-16
  - P-32

# Practice Nuclear Chemistry Test

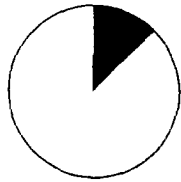
Base your answers to questions 10 and 11 on the graph below. The graph represents the decay of radioactive material *X* into a stable decay product.



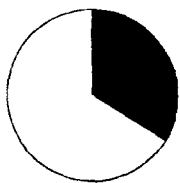
10. Which graph best represents the relative percentages of radioactive material *X* and its stable decay product after 15,000 years? (The shaded region represents radioactive material while the non-shaded region represents stable decay products.)



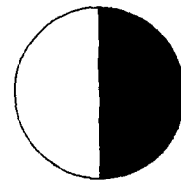
(1)



(3)



(2)

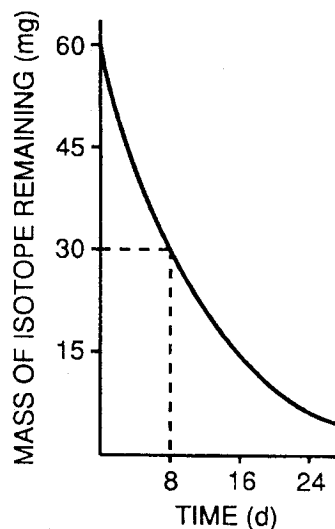


(4)

11. If radioactive material *X* were heated, the length of its half-life period would
- (1) decrease                      (3) remain the same  
(2) increase

\_\_\_\_\_

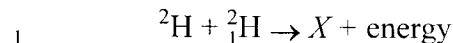
12. A 40.0 milligram sample of  $^{33}\text{P}$  decays to 10.0 milligrams in 50.0 days. What is the half-life of  $^{33}\text{P}$ ?
- (1) 12.5 days                      (3) 37.5 days  
(2) 25.0 days                      (4) 75.0 days
13. If 3.0 grams of  $^{90}\text{Sr}$  in a rock sample remained in 1989, approximately how many grams of  $^{90}\text{Sr}$  were present in the original rock sample in 1933?
- (1) 9.0 g                              (3) 3.0 g  
(2) 6.0 g                              (4) 12. g
14. The graph below represents the decay of a radioactive isotope.



Based on Reference Table *H*, which radioisotope is best represented by the graph?

- (1)  $^{32}\text{P}$   
(2)  $^{131}\text{I}$   
(3)  $^{198}\text{Au}$   
(4)  $^{222}\text{Rn}$

15. Given the fusion reaction:

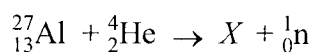


Which particle is represented by *X*?

- (1)  ${}_1^1\text{H}$   
(2)  ${}_2^3\text{He}$   
(3)  ${}_1^3\text{H}$   
(4)  ${}_2^4\text{He}$

## Practice Nuclear Chemistry Test

16. Given the reaction:



When the equation is correctly balanced, the nucleus represented by  $X$  is

- (1)  ${}_{13}^{30}\text{Al}$
- (2)  ${}_{14}^{30}\text{Si}$
- (3)  ${}_{15}^{30}\text{P}$
- (4)  ${}_{16}^{30}\text{S}$

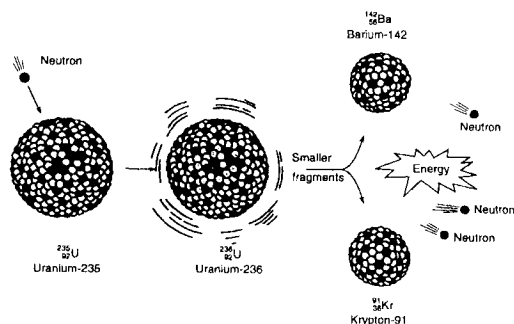
17. Artificial transmutation is brought about by using accelerated particles to bombard an atom's

- (1) nucleus
- (2) valence shells
- (3) occupied sublevels
- (4) inner principal energy levels

18. Which equation is an example of artificial transmutation?

- (1)  ${}_{92}^{238}\text{U} \rightarrow {}_2^4\text{He} + {}_{90}^{234}\text{Th}$
- (2)  ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
- (3)  ${}_6^{14}\text{C} \rightarrow {}_7^{14}\text{N} + {}_{-1}^0\text{e}$
- (4)  ${}_{88}^{226}\text{Ra} \rightarrow {}_2^4\text{He} + {}_{86}^{222}\text{Rn}$

19. The diagram below represents a nuclear reaction in which a neutron bombards a heavy nucleus.



Which type of reaction does the diagram illustrate?

- (1) fission
- (2) fusion
- (3) alpha decay
- (4) beta decay

20. Which statement best describes a primary occurrence in an uncontrolled fission reaction?

- (1) Mass is created and energy is released.
- (2) Mass is created and energy is stored.
- (3) Mass is converted to energy, which is released.
- (4) Mass is converted to energy, which is stored.

21. The fusion of hydrogen nuclei with the release of energy can be initiated by a fission reaction because the fission reaction provides a

- (1) high temperature and high pressure
- (2) high temperature and low pressure
- (3) good supply of hydrogen nuclei
- (4) good supply of neutrons

22. Which equation represents nuclear fusion?

- (1)  ${}_6^{14}\text{C} \rightarrow {}_7^{14}\text{N} + {}_{-1}^0\text{e}$
- (2)  ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$
- (3)  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{56}^{139}\text{Ba} + {}_{36}^{94}\text{Kr} + 3 {}_0^1\text{n}$
- (4)  ${}_1^2\text{H} + {}_1^3\text{H} \rightarrow {}_2^4\text{He} + {}_0^1\text{n}$

23. The energy released in a fusion reaction comes from

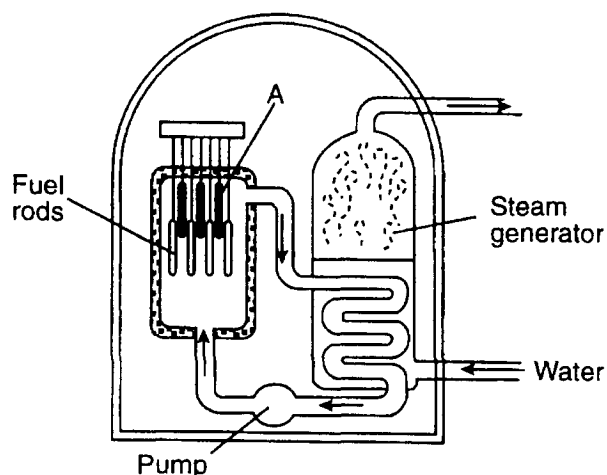
- (1) a conversion of some of the reactant's mass
- (2) the formation of chemical bonds by the reactants
- (3) the loss of kinetic energy of the reactants
- (4) the splitting of a nucleus

24. What is a problem commonly associated with nuclear power facilities?

- (1) A small quantity of energy is produced.
- (2) Reaction products contribute to acid rain.
- (3) It is impossible to control nuclear fission.
- (4) It is difficult to dispose of wastes.

## Practice Nuclear Chemistry Test

25. The diagram below represents a nuclear reactor. The arrows indicate the direction of the flow of water.



Which structure is indicated by letter A?

- (1) turbine                      (3) control rod  
(2) moderator                (4) internal shield
26. Which isotopic ratio needs to be determined when the age of ancient wooden objects is investigated?
- (1) uranium-235 to uranium-238  
(2) hydrogen-2 to hydrogen-3  
(3) nitrogen-16 to nitrogen-14  
(4) carbon-14 to carbon-12
27. The radioisotope I-131 is used to
- (1) control nuclear reactors  
(2) determine the age of fossils  
(3) diagnose thyroid disorders  
(4) trigger fusion reactors

## Practice Nuclear Chemistry Test

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Base your answers to questions **28** and **29** on the information below

In living organisms, the ratio of the naturally occurring isotopes of carbon, C-12 to C-13 to C-14, is fairly consistent. When an organism such as a woolly mammoth died, it stopped taking in carbon, and the amount of C-14 present in the mammoth began to decrease. For example, one fossil of a woolly mammoth is found to have of the amount of C-14 found in a living organism.

28. Identify the type of nuclear reaction that caused the amount of C-14 in the woolly mammoth to *decrease* after the organism died.
  29. Determine the total time that has elapsed since this woolly mammoth died.
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**Practice Nuclear Chemistry Test**  
**Answer Key**  
**practive nuke test [Nov 03, 2010]**

1. 4

2. 1

3. 1

4. 4

– beta decay – radioactive decay

5. 1

6. 3

7. 3

8. 1

9. 3

10. 3

11. 3

12. 2

13. 4

14. 2

15. 4

16. 3

17. 1

18. 2

19. 1

20. 3

21. 1

22. 4

23. 1

24. 4

25. 3

26. 4

27. 3

28. *Examples:* – natural transmutation – transmutation

29. 28 650 y

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