

## Nuclear Chemistry - Radioactive Decay *(answers at end)*

1. What particle is emitted when a Fr-210 nucleus decays to At-206?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton
2. What particle is emitted when a Ra-221 nucleus decays to Rn-217?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton
3. What particle is emitted when a Th-228 nucleus decays to Ra-224?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton
4. What particle is emitted when a F-20 nucleus decays to Ne-20?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton
5. What particle is emitted when an Ar-39 nucleus decays to K-39?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton
6. What particle is emitted when a Sr-90 nucleus decays radioactively to Y-90?
  - (a) alpha
  - (b) beta
  - (c) neutron
  - (d) positron
  - (e) proton

7. What particle is emitted when a carbon-11 nucleus decays to boron-11?
- alpha
  - beta
  - neutron
  - positron
  - proton
8. What particle is emitted when a fluorine-17 nucleus decays to oxygen-17?
- alpha
  - beta
  - neutron
  - positron
  - proton
9. What particle is emitted when a neon-19 nucleus decays to fluorine-19?
- alpha
  - beta
  - neutron
  - positron
  - proton
10. What nuclide is produced when Pt-175 decays by alpha emission?
- $^{171}_{76}\text{Os}$
  - $^{175}_{76}\text{Os}$
  - $^{171}_{78}\text{Pt}$
  - $^{175}_{79}\text{Au}$
  - $^{171}_{79}\text{Au}$
11. What nuclide is produced when U-235 decays by alpha emission?
- $^{231}_{90}\text{Th}$
  - $^{235}_{90}\text{Th}$
  - $^{231}_{92}\text{U}$
  - $^{235}_{93}\text{Np}$
  - $^{231}_{93}\text{Np}$
12. What nuclide is produced when Ra-223 decays by alpha and gamma emission?
- $^{219}_{86}\text{Rn}$
  - $^{227}_{86}\text{Rn}$
  - $^{219}_{88}\text{Ra}$
  - $^{227}_{90}\text{Th}$
  - $^{219}_{90}\text{Th}$

13. What radionuclide decays to Pb-210 by alpha emission?
- (a)  $^{206}_{80}\text{Hg}$
- (b)  $^{214}_{80}\text{Hg}$
- (c)  $^{206}_{82}\text{Pb}$
- (d)  $^{214}_{84}\text{Po}$
- (e)  $^{84}_{84}\text{Po}$
14. What nuclide is produced when K-43 decays by beta emission?
- (a)  $^{43}_{18}\text{Ar}$
- (b)  $^{42}_{19}\text{K}$
- (c)  $^{42}_{20}\text{Ca}$
- (d)  $^{43}_{20}\text{Ca}$
- (e)  $^{44}_{20}\text{Ca}$
15. What nuclide is produced when Pb-210 decays by beta emission?
- (a)  $^{210}_{81}\text{Tl}$
- (b)  $^{212}_{81}\text{Tl}$
- (c)  $^{210}_{82}\text{Pb}$
- (d)  $^{211}_{83}\text{Bi}$
- (e)  $^{83}_{83}\text{Bi}$
16. What nuclide is produced when Ar-39 decays by beta and gamma emission?
- (a)  $^{39}_{17}\text{Cl}$
- (b)  $^{40}_{17}\text{Cl}$
- (c)  $^{39}_{18}\text{Ar}$
- (d)  $^{40}_{19}\text{K}$
- (e)  $^{19}_{19}\text{K}$
17. What radionuclide decays to Fe-56 by beta emission?
- (a)  $^{55}_{25}\text{Mn}$
- (b)  $^{56}_{25}\text{Mn}$
- (c)  $^{56}_{26}\text{Fe}$
- (d)  $^{57}_{27}\text{Co}$
- (e)  $^{27}_{27}\text{Co}$

18. What nuclide is produced when N-13 decays by positron emission?
- (a)  ${}^{12}_6\text{C}$
  - (b)  ${}^{13}_6\text{C}$
  - (c)  ${}^{14}_6\text{C}$
  - (d)  ${}^{14}_7\text{N}$
  - (e)  ${}^{13}_8\text{O}$
19. What nuclide is produced when O-15 decays by positron emission?
- (a)  ${}^{14}_7\text{N}$
  - (b)  ${}^{15}_7\text{N}$
  - (c)  ${}^{14}_8\text{O}$
  - (d)  ${}^{15}_9\text{F}$
  - (e)  ${}^{16}_9\text{F}$
20. What nuclide is produced when K-40 decays by positron emission?
- (a)  ${}^{39}_{18}\text{Ar}$
  - (b)  ${}^{40}_{18}\text{Ar}$
  - (c)  ${}^{41}_{18}\text{Ar}$
  - (d)  ${}^{40}_{19}\text{K}$
  - (e)  ${}^{40}_{20}\text{Ca}$
21. What radionuclide decays to Br-73 by positron emission?
- (a)  ${}^{72}_{34}\text{Se}$
  - (b)  ${}^{74}_{34}\text{Se}$
  - (c)  ${}^{72}_{35}\text{Br}$
  - (d)  ${}^{74}_{35}\text{Br}$
  - (e)  ${}^{73}_{36}\text{Kr}$
22. What nuclide is produced when a Cs-129 nucleus decays by electron capture?
- (a)  ${}^{128}_{54}\text{Xe}$
  - (b)  ${}^{129}_{54}\text{Xe}$
  - (c)  ${}^{128}_{55}\text{Cs}$
  - (d)  ${}^{128}_{56}\text{Ba}$
  - (e)  ${}^{129}_{56}\text{Ba}$

23. What nuclide is produced when a W-181 nucleus decays by electron capture?

- (a)  $^{180}_{73}\text{Ta}$
- (b)  $^{181}_{73}\text{Ta}$
- (c)  $^{180}_{74}\text{W}$
- (d)  $^{180}_{75}\text{Re}$
- (e)  $^{181}_{75}\text{Re}$

24. What nuclide is produced when a Mn-52 nucleus decays by electron capture?

- (a)  $^{52}_{24}\text{Cr}$
- (b)  $^{53}_{24}\text{Cr}$
- (c)  $^{53}_{25}\text{Mn}$
- (d)  $^{52}_{26}\text{Fe}$
- (e)  $^{53}_{26}\text{Fe}$

25. What radionuclide decays to Cs-133 by electron capture?

- (a)  $^{132}_{54}\text{Xe}$
- (b)  $^{133}_{54}\text{Xe}$
- (c)  $^{134}_{55}\text{Cs}$
- (d)  $^{133}_{56}\text{Ba}$
- (e)  $^{134}_{56}\text{Ba}$

### Radioactive Decay Series

26. In the final step of the uranium-238 disintegration series, the parent nuclide decays to lead-206 and an alpha particle. What is the parent nuclide?

- (a)  $^{202}_{80}\text{Hg}$
- (b)  $^{210}_{83}\text{Bi}$
- (c)  $^{206}_{84}\text{Po}$
- (d)  $^{210}_{84}\text{Po}$
- (e) none of the above

27. In the final step of the uranium-235 disintegration series, the parent nuclide decays to lead-207 and a beta particle. What is the parent nuclide?

- (a)  $^{207}_{81}\text{Tl}$
- (b)  $^{206}_{82}\text{Pb}$
- (c)  $^{208}_{82}\text{Pb}$
- (d)  $^{207}_{83}\text{Bi}$
- (e) none of the above

28. In the final step of the thorium-232 disintegration series, the parent nuclide decays to lead-208 and an alpha particle. What is the parent nuclide?
- (a)  $^{208}_{83}\text{Bi}$   
 (b)  $^{212}_{83}\text{Bi}$   
 (c)  $^{208}_{84}\text{Po}$   
 (d)  $^{212}_{84}\text{Po}$   
 (e) none of the above
29. The uranium-238 decay series begins with the emission of an alpha particle. If the daughter decays by beta emission, what is the resulting nuclide?
- (a)  $^{234}_{89}\text{Ac}$   
 (b)  $^{233}_{90}\text{Th}$   
 (c)  $^{234}_{90}\text{Th}$   
 (d)  $^{233}_{91}\text{Pa}$   
 (e)  $^{234}_{91}\text{Pa}$
30. The uranium-235 decay series begins with the emission of an alpha particle. If the daughter decays by beta emission, what is the resulting nuclide?
- (a)  $^{231}_{89}\text{Ac}$   
 (b)  $^{230}_{90}\text{Th}$   
 (c)  $^{231}_{90}\text{Th}$   
 (d)  $^{230}_{91}\text{Pa}$   
 (e)  $^{231}_{91}\text{Pa}$
31. The thorium-232 decay series begins with the emission of an alpha particle. If the daughter decays by beta emission, what is the resulting nuclide?
- (a)  $^{228}_{87}\text{Fr}$   
 (b)  $^{227}_{88}\text{Ra}$   
 (c)  $^{228}_{88}\text{Ra}$   
 (d)  $^{227}_{89}\text{Ac}$   
 (e)  $^{228}_{89}\text{Ac}$

# Answer Key

1A, 2A, 3A, 4B, 5B, 6B, 7D, 8D, 9D, 10A, 11A, 12A, 13E, 14D, 15D, 16D, 17B, 18B, 19B, 20B, 21E, 22B, , 23B, 24A, 25D, 26D, 27A, 28D, 29E, 30E, 31E