Nuclear Chemistry Problems - 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?
   (a) alpha
   (b) beta
   (c) neutron
   (d) positron
   (e) proton

8. What particle is emitted when a fluorine-17 nucleus decays to oxygen-17?
   (a) alpha
   (b) beta
   (c) neutron
   (d) positron
   (e) proton

9. What particle is emitted when a neon-19 nucleus decays to fluorine-19?
   (a) alpha
   (b) beta
   (c) neutron
   (d) positron
   (e) proton

10. What nuclide is produced when Pt-175 decays by alpha emission?
   (a) $^{171}_{76}\mathrm{Os}$
   (b) $^{175}_{76}\mathrm{Os}$
   (c) $^{171}_{78}\mathrm{Pt}$
   (d) $^{171}_{79}\mathrm{Au}$
   (e) $^{175}_{79}\mathrm{Au}$

11. What nuclide is produced when U-235 decays by alpha emission?
   (a) $^{231}_{90}\mathrm{Th}$
   (b) $^{235}_{90}\mathrm{Th}$
   (c) $^{231}_{92}\mathrm{U}$
   (d) $^{235}_{93}\mathrm{Np}$
   (e) $^{231}_{93}\mathrm{Np}$

12. What nuclide is produced when Ra-223 decays by alpha and gamma emission?
    (a) $^{219}_{86}\mathrm{Rn}$
    (b) $^{227}_{86}\mathrm{Rn}$
    (c) $^{227}_{88}\mathrm{Ra}$
    (d) $^{219}_{90}\mathrm{Th}$
    (e) $^{227}_{90}\mathrm{Th}$

13. What radionuclide decays to Pb-210 by alpha emission?
    (a) $^{206}_{80}\mathrm{Hg}$
    (b) $^{214}_{80}\mathrm{Hg}$
    (c) $^{206}_{82}\mathrm{Pb}$
    (d) $^{206}_{84}\mathrm{Po}$
    (e) $^{214}_{84}\mathrm{Po}$

14. What nuclide is produced when K-43 decays by beta emission?
    (a) $^{43}_{18}\mathrm{Ar}$
    (b) $^{42}_{19}\mathrm{K}$
    (c) $^{42}_{20}\mathrm{Ca}$
    (d) $^{43}_{20}\mathrm{Ca}$
    (e) $^{44}_{20}\mathrm{Ca}$

15. What nuclide is produced when Pb-210 decays by beta emission?
    (a) $^{210}_{81}\mathrm{Tl}$
    (b) $^{212}_{81}\mathrm{Tl}$
    (c) $^{211}_{82}\mathrm{Pb}$
    (d) $^{210}_{83}\mathrm{Bi}$
    (e) $^{211}_{83}\mathrm{Bi}$

16. What nuclide is produced when Ar-39 decays by beta and gamma emission?

(a) $^{39}_{17}\mathrm{Cl}$

(b) $^{40}_{17}\mathrm{Cl}$

(c) $^{40}_{18}\mathrm{Ar}$

(d) $^{39}_{19}\mathrm{K}$

(e) $^{40}_{19}\mathrm{K}$

17. What radionuclide decays to Fe-56 by beta emission?

(a) $^{55}_{25}\mathrm{Mn}$

(b) $^{56}_{25}\mathrm{Mn}$

(c) $^{55}_{26}\mathrm{Fe}$

(d) $^{56}_{27}\mathrm{Co}$

(e) $^{57}_{27}\mathrm{Co}$

18. What nuclide is produced when N-13 decays by positron emission?

(a) $^{12}_{6}\mathrm{C}$

(b) $^{13}_{6}\mathrm{C}$

(c) $^{14}_{6}\mathrm{C}$

(d) $^{14}_{7}\mathrm{N}$

(e) $^{13}_{8}\mathrm{O}$

19. What nuclide is produced when O-15 decays by positron emission?

(a) $^{14}_{7}\mathrm{N}$

(b) $^{15}_{7}\mathrm{N}$

(c) $^{14}_{8}\mathrm{O}$

(d) $^{15}_{9}\mathrm{F}$

(e) $^{16}_{9}\mathrm{F}$

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) $^{132}_{133}\text{Xe}$

(b) $^{134}_{54}\text{Xe}$

(c) $^{133}_{55}\text{Cs}$

(d) $^{134}_{56}\text{Ba}$

(e) $^{}_{56}\text{Ba}$

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