Chapter 21

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) In balancing the nuclear reaction $^{293}_{92}\text{U} \rightarrow {}^{234}_{90}\text{E} + {}^{4}_{2}\text{He}$, the identity of element E is _____ . 1) _____

A) Pu. B) U. C) Th. D) Np. E) Pa.

2) This reaction is an example of _____. 2) _____

$$^{210}_{84}\text{Po} \rightarrow {}^{206}_{82}\text{Pb} + \text{\_\_\_\_\_}$$

A) alpha decay

B) positron emission

C) gamma emission

D) beta emission

E) electron capture

3) The missing product from this reaction is 3) _____

$$^{121}_{53}\text{I} \rightarrow {}^{121}_{52}\text{Te} + \text{\_\_\_\_\_}$$

A) $^{0}_{-1}\text{e}$ B) $^{0}_{0}\gamma$ C) $^{4}_{2}\text{He}$ D) $^{1}_{0}\text{n}$ E) $^{0}_{1}\text{e}$

4) This reaction is an example of _____. 4) _____

$$^{41}_{20}\text{Ca} \rightarrow {}^{41}_{19}\text{K} + \text{\_\_\_\_\_}$$

A) alpha decay

B) beta decay

C) positron decay

D) gamma emission

E) electron capture

5) The missing product in this reaction would be found in which group of the periodic table? 5) _____

$$^{24}_{11}\text{Na} \rightarrow {}^{0}_{-1}\text{e} + \text{\_\_\_\_\_}$$

A) 3A B) 7A C) 1A D) 8A E) 2A

6) The missing product in this reaction combines with oxygen to form a compound with the formula 6) _____

$$^{42}_{19}K \rightarrow {}^{0}_{-1}e + \_\_\_\_\_$$

A) MO_2 B) M_2O C) M_3O_2 D) MO E) M_2O_3

7) Radium undergoes alpha decay. The product of this reaction also undergoes alpha decay. What is the product of this second decay reaction _____ ? 7) _____

A) Po B) Hg C) U D) Rn E) Th

8) What is the mass number of a neutron _____ ? 8) _____

A) 1 B) 3 C) 2 D) 0 E) 4

9) Nuclei above the belt of stability can lower their neutron–to–proton ratio by_____ 9) _____

A) gamma emission.

B) positron emission.

C) beta emission.

D) electron capture.

E) Any of the above processes will lower the neutron–to–proton ratio.

10) What is the largest number of protons that can exist in a nucleus and still be stable _____ ? 10) _____

A) 83 B) 206 C) 92 D) 50 E) 84

11) The three radioactive series that occur in nature end with what element _____ ? 11) _____

A) Hg B) Bi C) Po D) U E) Pb

12) The largest number of stable nuclei have an _____ number of protons and an _____ number of neutrons. 12) _____

A) odd, odd

B) even, odd

C) odd, even

D) even, equal

E) even, even

13) In the nuclear transmutation represented by ${}^{16}_{8}\mathrm{O}(\mathrm{p}, \alpha)\ {}^{13}_{7}\mathrm{N}$, the emitted particle is _____. 13) _____

A) a beta particle.

B) a neutron.

C) an alpha particle.

D) a positron.

E) a proton.

14) Bombardment of uranium–235 with a neutron generates tellurium–135, 3 neutrons, and _____. 14) _____

A) krypton–103.

B) strontium–99.

C) zirconium–99.

D) krypton–101.

E) zirconium–98.

15) The reaction shown below is responsible for creating ${}^{14}\mathrm{C}$ in the atmosphere. What is the bombarding particle _____ ? 15) _____

$$ {}^{14}_{7}\mathrm{N} + \_\_\_\_\_ \rightarrow {}^{14}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H} $$

A) electron

B) proton

C) positron

D) alpha particle

E) neutron

16) What order process is radioactive decay _____ ? 16) _____

A) zeroth B) first C) second D) third E) fourth

17) ${}^{131}\mathrm{I}$ has a half–life of 8.04 days. Assuming you start with a 1.53 mg sample of ${}^{131}\mathrm{I}$, how many mg will remain after 13.0 days _____ ? 17) _____

A) 0.440 B) 0.422 C) 0.268 D) 0.835 E) 0.499

18) The decay of a radionuclide with a half–life of 4.3×10^{5} years has a rate constant (in yr^{-1}) equal to _____. 18) _____

A) 2.8×10^{3}. B) 6.2×10^{5}. C) 1.6×10^{-6}. D) 2.3×10^{-6}. E) 5.9×10^{-8}.

19) All atoms of a given element have the same 19) _____

A) atomic mass.

B) mass number.

C) number of nucleons.

D) atomic number.

E) number of neutrons.

20) Atoms containing radioactive nuclei are called 20) _____

A) radioisotopes.

B) radionuclides.

C) nuclides.

D) nucleons.

E) radioisophores.

21) What happens to the mass number and the atomic number of an element when it undergoes beta decay? 21) _____

A) The mass number decreases by 4 and the atomic number decreases by 2.

B) The mass number does not change and the atomic number decreases by 2.

C) Neither the mass number nor the atomic number change.

D) The mass number increases by 2 and the atomic number increases by 1.

E) The mass number does not change and the atomic number increases by 1.

22) Which one of the following is a correct representation of a beta particle? 22) _____

A) ${}^{0}_{1}\mathrm{e}$ B) ${}^{0}_{-1}\mathrm{e}$ C) ${}^{1}_{0}\beta$ D) ${}^{4}_{2}\mathrm{e}$ E) ${}^{2}_{4}\beta$

23) Which one of the following processes results in an increase in the atomic number? 23) _____

A) alpha emission

B) gamma emission

C) corrosion

D) positron emission

E) beta emission

24) Of the following processes, which one changes the atomic number? 24) _____

A) beta emission

B) positron emission

C) electron capture

D) alpha emission

E) All of these processes change the atomic numbers.

25) Which type of radioactive decay results in no change in mass number and atomic number for the starting nucleus? 25) _____

A) beta

B) positron emission

C) alpha

D) electron capture

E) gamma

26) Alpha decay produces a new nucleus whose _____ than those respectively of the original nucleus. 26) _____

A) atomic number is 2 more and mass number is 4 more

B) atomic number is 2 less and mass number is 2 less

C) atomic number is 1 less and mass number is 2 less

D) atomic number is 2 less and mass number is 4 less

E) atomic number is 2 more and mass number is 2 less

27) What is the missing product from this reaction? 27) _____

$$^{32}_{15}\mathrm{P} \rightarrow {}^{32}_{16}\mathrm{S} + \_\_\_\_\_$$

A) $^{0}_{1}\mathrm{p}$ B) $^{0}_{-1}\mathrm{e}$ C) $^{0}_{0}\gamma$ D) $^{0}_{1}\mathrm{e}$ E) $^{4}_{2}\mathrm{He}$

28) What is the atomic number of a neutron _____ ? 28) _____

A) 4 B) 2 C) 0 D) 1 E) 3

29) What happens to the mass number and the atomic number of an element when it emits gamma radiation? 29) _____

A) The mass number increases by four and the atomic number increases by two.

B) The mass number and atomic numbers remain unchanged.

C) The mass number decreases by four and the atomic number decreases by two.

D) The mass number remains unchanged while the atomic number decreases by one.

E) The mass number remains unchanged while the atomic number increases by one.

30) Atoms with the same atomic number and different mass numbers 30) _____

A) are allotropes

B) are resonance structures.

C) do not exist.

D) are isomers.

E) are isotopes.

31) At approximately what number of protons, or neutrons, does the 1:1 ratio of protons to neutrons start to produce unstable nuclei? 31) _____

A) 10 B) 50 C) 30 D) 80 E) 20

32) What is required for a nuclear transmutation to occur? 32) _____

A) a corrosive environment

B) a particle to collide with a nucleus

C) gamma emission

D) spontaneous nuclear decay

E) very high temperature

33) In the nuclear transmutation, ${}^{16}_{8}\mathrm{O}\ (\mathrm{p}, \alpha)\ {}^{13}_{7}\mathrm{N}$, what is the bombarding particle? 33) _____

A) a gamma photon

B) a proton

C) a beta particle

D) an alpha particle

E) a phosphorus nucleus

34) Which one of the following can be done to shorten the half–life of the radioactive decay of uranium–238? 34) _____

A) heat it

B) freeze it

C) convert it to UF_6

D) oxidize it to the +2 oxidation state

E) none of the above

35) The beta decay of cesium–137 has a half–life of 30 years. How many years must pass to reduce a 25 mg sample of cesium 137 to 8.7 mg? 35) _____

A) 32 B) 3.2 C) 52 D) 50 E) 46

36) The half–life for beta decay of strontium–90 is 28.8 years. A milk sample is found to contain 10.3 ppm strontium–90. How many years would pass before the strontium–90 concentration would drop to 1.0 ppm? 36) _____

A) 92.3 B) 96.9 C) 186 D) 0.112 E) 131

37) The basis for the carbon–14 dating method is that 37) _____

A) carbon–14 is very unstable and is readily lost from the atmosphere.

B) living tissue will not absorb carbon–14 but will absorb carbon–12.

C) the ratio of carbon–14 to carbon–12 in the atmosphere is a constant.

D) the amount of carbon–14 in all objects is the same.

E) All of the above are correct.

38) ^{210}Pb has a half–life of 22.3 years and decays to produce ^{206}Hg. If you start with 7.50 g of ^{210}Pb, how many grams of ^{206}Hg will you have after 17.5 years? 38) _____

A) 4.35 B) 3.09 C) 1.71 D) 3.15 E) 0.0600

39) The half–life of a radionuclide 39) _____

A) gets shorter with increased temperature.

B) is constant.

C) gets longer with increased temperature.

D) gets shorter with passing time.

E) gets longer with passing time.

Answer Key
Testname: CHAPTER 21 PRACTICE QUESTIONS

1) C
2) A
3) E
4) C
5) E
6) D
7) A
8) A
9) C
10) A
11) E
12) E
13) C
14) E
15) E
16) B
17) E
18) C
19) D
20) A
21) E
22) B
23) E
24) E
25) E
26) D
27) B
28) C
29) B
30) E
31) E
32) B
33) B
34) E
35) E
36) B
37) C
38) B
39) B