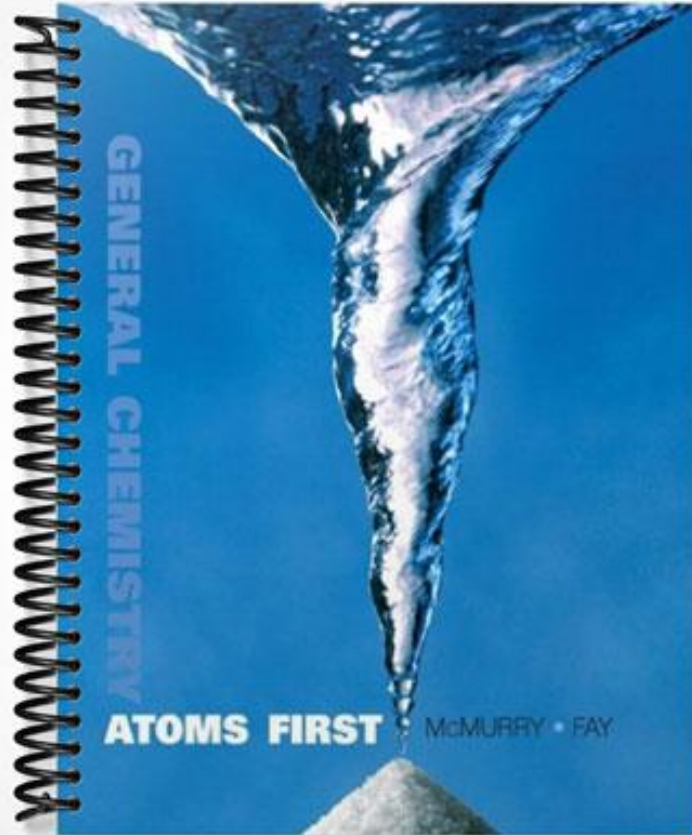


TEST BANK



General Chemistry: Atoms First (McMurry/Fay/Pribush)
Chapter 2 The Structure and Stability of Atoms

2.1 Multiple Choice Questions

- 1) According to history, the concept that all matter is composed of atoms was first proposed by
- A) the Greek philosopher Democritus, but not widely accepted until modern times.
 - B) Dalton, but not widely accepted until the work of Mendeleev.
 - C) Dalton, but not widely accepted until the work of Einstein.
 - D) Dalton, and widely accepted within a few decades.

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

- 2) The observation that 15.0 g of hydrogen reacts with 120.0 g of oxygen to form 135.0 g of water is evidence for the law of
- A) definite proportions.
 - B) energy conservation.
 - C) mass conservation.
 - D) multiple proportions.

Answer: C

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

- 3) The observation that 4.0 g of hydrogen reacts with 32.0 g of oxygen to form a product with O:H mass ratio = 8:1, and 6.0 g of hydrogen reacts with 48.0 g of oxygen to form the same product with O/H mass ratio = 8:1 is evidence for the law of
- A) definite proportions.
 - B) energy conservation.
 - C) mass conservation.
 - D) multiple proportions.

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

- 4) Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 3.2 g of methane reacts with 12.8 g of oxygen to produce 8.8 g of carbon dioxide?
- A) 7.2 g
 - B) 8.8 g
 - C) 14.8 g
 - D) 16.0 g

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

5) Sodium metal and water react to form hydrogen and sodium hydroxide. If 5.98 g of sodium react with water to form 0.26 g of hydrogen and 10.40 g of sodium hydroxide, what mass of water was consumed in the reaction?

- A) 4.68 g
- B) 5.98 g
- C) 10.14 g
- D) 10.66 g

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

6) A sample of pure lithium carbonate contains 18.8% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?

- A) 9.40%
- B) 18.8%
- C) 37.6%
- D) 75.2%

Answer: B

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

7) A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 45.0 g of calcium fluoride?

- A) 2.56 g
- B) 7.70 g
- C) 15.0 g
- D) 23.1 g

Answer: D

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

8) The observation that hydrogen and oxygen can react to form two compounds with different chemical and physical properties, one having an O:H mass ratio = 8:1 and the other having an O:H mass ratio = 16:1 is consistent with the law of

- A) definite proportions.
- B) energy conservation.
- C) mass conservation.
- D) multiple proportions.

Answer: D

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

9) Which of the following statements is **not** a postulate of Dalton's atomic theory?

- A) Each element is characterized by the mass of its atoms.
- B) Atoms are composed of protons, neutrons, and electrons.
- C) Chemical reactions only rearrange atomic combinations.
- D) Elements are composed of atoms.

Answer: B

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

10) Which of the following is a part of Dalton's atomic theory?

- A) Atoms are rearranged but not changed during a chemical reaction.
- B) Atoms break down during radioactive decay.
- C) Atoms contain protons, neutrons, and electrons.
- D) Isotopes of the same element have different masses.

Answer: A

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

11) Which of the following is **not** explained by Dalton's atomic theory?

- A) conservation of mass during a chemical reaction
- B) the existence of more than one isotope of an element
- C) the law of definite proportions
- D) the law of multiple proportions

Answer: B

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

12) Elements A and Q form two compounds, AQ and A₂Q₃. The mass ratio (mass Q)/(mass A) for AQ is 0.574. What is the mass ratio (mass Q)/(mass A) for A₂Q₃?

- A) 0.383
- B) 0.861
- C) 1.16
- D) 2.61

Answer: B

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

Algo. Option: algorithmic

13) Elements A and Q form two compounds, AQ and A₂Q. Which of the following must be true?

- A) (mass Q)/(mass A) is one for AQ, and 1/2 for A₂Q.
- B) (mass Q)/(mass A) for AQ must equal (mass Q)/(mass A) for A₂Q.
- C) (mass Q)/(mass A) for AQ must be 2 times (mass Q)/(mass A) for A₂Q.
- D) (mass Q)/(mass A) for AQ must be 1/2 (mass Q)/(mass A) for A₂Q.

Answer: C

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

14) Elements A and Q form two compounds. The ratio (mass Q)/(mass A) for compound one is 0.271 and ratio (mass Q)/(mass A) for compound two is 0.362. If compound one has the chemical formula AQ, what is the chemical formula for compound two?

- A) A₃Q₄
- B) A₂Q₃
- C) AQ₂
- D) AQ₃

Answer: A

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

Algo. Option: algorithmic

15) The existence of electrons in atoms of all elements was demonstrated by

- A) Millikan's oil drop experiment.
- B) Rutherford's gold foil experiment.
- C) Thomson's cathode ray tube experiment.
- D) None of the above.

Answer: C

Topic: Section 2.3 Atomic Structure: Electrons

16) The charge-to-mass ratio of an electron was established by

- A) Millikan's oil drop experiment.
- B) Rutherford's gold foil experiment.
- C) Thomson's cathode ray tube experiment.
- D) None of the above.

Answer: C

Topic: Section 2.3 Atomic Structure: Electrons

17) The current model of the atom in which essentially all of an atom's mass is contained in a very small nucleus, whereas most of an atom's volume is due to the space in which the atom's electrons move was established by

- A) Millikan's oil drop experiment.
- B) Rutherford's gold foil experiment.
- C) Thomson's cathode ray tube experiment.
- D) None of the above.

Answer: B

Topic: Section 2.4 Atomic Structure: Protons and Neutrons

18) The existence of neutrons in the nucleus of an atom was demonstrated by

- A) Millikan's oil drop experiment.
- B) Rutherford's gold foil experiment.
- C) Thomson's cathode ray tube experiment.
- D) None of the above.

Answer: D

Topic: Section 2.4 Atomic Structure: Protons and Neutrons

19) Most of the alpha particles directed at a thin gold foil in Rutherford's experiment

- A) bounced directly back from the foil.
- B) passed directly through the foil undeflected.
- C) passed through the foil but were deflected at an angle.
- D) were absorbed by the foil.

Answer: B

Topic: Section 2.4 Atomic Structure: Protons and Neutrons

20) Which subatomic particle has the smallest mass?

- A) a proton
- B) a neutron
- C) an electron
- D) an alpha particle

Answer: C

Topic: Section 2.4 Atomic Structure: Protons and Neutrons

21) Which of the following two atoms are isotopes?

- A) ${}^{40}_{18}\text{Ar}$ and ${}^{40}_{20}\text{Ca}$
- B) ${}^{12}_6\text{C}$ and ${}^{13}_6\text{C}$
- C) ${}^{35}_{17}\text{Cl}$ and ${}^{80}_{35}\text{Br}$
- D) ${}^{24}_{12}\text{Mg}$ and ${}^{12}_6\text{C}$

Answer: B

Topic: Section 2.5 Atomic Numbers

22) Which are isotopes? An atom that has an atomic number of 34 and a mass number of 76 is an isotope of an atom that has

- A) an atomic number of 32 and a mass number of 76.
- B) an atomic number of 34 and a mass number of 80.
- C) 42 neutrons and 34 protons.
- D) 42 protons and 34 neutrons.

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

23) Which of the following represent isotopes?

A: $\frac{25}{21}[\]$ B: $\frac{21}{25}[\]$ C: $\frac{27}{21}[\]$ D: $\frac{25}{23}[\]$

- A) A and B
- B) A and C
- C) A and D
- D) C and D

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

24) The isotope represented by ${}^{13}_6\text{C}$ is named

- A) carbon-6
- B) carbon-7
- C) carbon-13
- D) carbon-19

Answer: C

Topic: Section 2.5 Atomic Numbers

25) Boron-9 can be represented as

- A) ${}^9_4\text{B}$.
- B) ${}^9_5\text{B}$.
- C) ${}^{14}_5\text{B}$.
- D) ${}^{14}_9\text{B}$.

Answer: B

Topic: Section 2.5 Atomic Numbers

26) How many protons (p) and neutrons (n) are in an atom of ${}^{90}_{38}\text{Sr}$?

- A) 38 p, 52 n
- B) 38 p, 90 n
- C) 52 p, 38 n
- D) 90 p, 38 n

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

27) How many protons (p) and neutrons (n) are in an atom of calcium-46?

- A) 20 p, 26 n
- B) 20 p, 46 n
- C) 26 p, 20 n
- D) 46 p, 60 n

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

28) What is the chemical symbol for an atom that has 29 protons and 36 neutrons?

- A) Cu
- B) Kr
- C) N
- D) Tb

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

29) How many electrons are in a neutral atom of iodine-131?

- A) 1
- B) 53
- C) 54
- D) 131

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

30) How many protons (p), neutrons (n), and electrons (e) are in one atom of $^{23}_{12}\text{Mg}$?

- A) 12 p, 12 n, 12 e
- B) 12 p, 11 n, 12 e
- C) 12 p, 11 n, 10 e
- D) 12 p, 11 n, 14 e

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

31) Identify the chemical symbol of element Q in $^{80}_{94}\text{Q}$.

- A) Br
- B) Hg
- C) Pd
- D) Se

Answer: D

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

32) The atoms of a particular element all have the same number of protons as neutrons. Which of the following must be true?

- A) The atomic weight must be a whole number.
- B) The mass number for each atom must equal the atomic weight of the element.
- C) The mass number must be exactly twice the atomic number for each atom.
- D) All of the above are true.

Answer: C

Topic: Section 2.5 Atomic Numbers

33) The smallest sample of carbon atoms that can be observed with the naked eye has a mass of approximately 2×10^{-8} g. Given that $1 \text{ g} = 6.02 \times 10^{23}$ amu, and that carbon has an atomic weight of 12.01 amu, determine the number of carbon atoms present in the sample.

- A) 1×10^{15}
- B) 1×10^{16}
- C) 1×10^{17}
- D) 6×10^{23}

Answer: A

Topic: Section 2.6 Atomic Masses and the Mole

34) An element has two naturally occurring isotopes. One has an abundance of 37.40% and an isotopic mass of 184.953 amu, and the other has an abundance of 62.60% and a mass of 186.956 amu. What is the atomic weight of the element?

- A) 185.7 amu
- B) 186.0 amu
- C) 186.2 amu
- D) 187.0 amu

Answer: C

Topic: Section 2.6 Atomic Masses and the Mole

35) The element antimony has an atomic weight of 121.757 amu and only two naturally-occurring isotopes. One isotope has an abundance of 57.30% and an isotopic mass of 120.904 amu. Based on these data, what is the mass of the other isotope?

- A) 121.8 amu
- B) 122.4 amu
- C) 122.6 amu
- D) 122.9 amu

Answer: D

Topic: Section 2.6 Atomic Masses and the Mole

36) What is the standard isotope that is used to define the number of atoms in a mole?

A) ^1H

B) ^{12}C

C) ^{16}O

D) ^{20}Ne

Answer: B

Topic: Section 2.6 Atomic Masses and the Mole

37) One mole of which element has the smallest mass?

A) Co

B) Cu

C) Ni

D) Zn

Answer: C

Topic: Section 2.6 Atomic Masses and the Mole

38) 24.0 g of which element contains the greatest number of atoms?

A) B

B) C

C) N

D) O

Answer: A

Topic: Section 2.6 Atomic Masses and the Mole

39) How many moles and how many atoms of zinc are in a sample weighing 34.9 g?

A) 0.533 mol, 8.85×10^{-25} atoms

B) 0.533 mol, 3.21×10^{23} atoms

C) 1.87 mol, 3.10×10^{-24} atoms

D) 1.87 mol, 1.13×10^{24} atoms

Answer: B

Topic: Section 2.6 Atomic Masses and the Mole

40) Which statement about nuclear reactions is **true**?

A) New elements are never produced in a nuclear reaction.

B) Nuclear reactions involve valence electrons.

C) The rate of a nuclear reaction is affected by catalysts.

D) Tremendous amounts of energy are involved in nuclear reactions.

Answer: D

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

41) The term "nucleons" refers to the number of _____ in the atom.

- A) neutrons
- B) protons
- C) protons and neutrons
- D) protons, neutrons, and electrons

Answer: C

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

42) The number of nucleons in an atom or ion is the same as the

- A) atomic number.
- B) charge on the atom or ion.
- C) mass number.
- D) none of these

Answer: C

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

43) The number of nucleons in a ${}_{92}^{236}\text{U}^{2+}$ nucleus is

- A) 92.
- B) 144.
- C) 236.
- D) 328.

Answer: C

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

Algo. Option: algorithmic

44) The number of neutrons in ${}_{26}^{55}\text{Fe}^{2+}$ is

- A) 26.
- B) 29.
- C) 53.
- D) 55.

Answer: B

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

45) "Isotopes" are atoms with the same number of _____ but different number of _____.

- A) electrons, protons
- B) neutrons, protons
- C) protons, electrons
- D) protons, neutrons

Answer: D

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

46) The rate of a nuclear reaction can be changed by

- A) adding a catalyst.
- B) decreasing the pressure.
- C) increasing the temperature.
- D) none of the above

Answer: D

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

47) Which of the following statements is **not** correct when balancing a nuclear equation?

- I. The mass numbers must be conserved on both sides of the reaction arrow.
- II. The ionic charges must be conserved on both sides of the reaction arrow.
- III. The atomic numbers must be conserved on both sides of the reaction arrow.
- IV. The elements must be the same on both sides of the reaction arrow.

- A) II only
- B) II and III
- C) I and III
- D) II and IV

Answer: D

Topic: Section 2.8 Radioactivity

48) An alpha particle is

- A) ${}^1_1\text{H}^+$.
- B) ${}^2_1\text{H}^+$.
- C) ${}^3_1\text{H}^+$.
- D) ${}^4_2\text{H}^{2+}$.

Answer: D

Topic: Section 2.8 Radioactivity

49) When a substance decays by alpha radiation, the mass number of the nucleus _____ and the atomic number _____.

- A) increases by 4, increases by 2
- B) reduces by 4, reduces by 2
- C) increases by 2, increases by 4
- D) reduces by 2, reduces by 4

Answer: B

Topic: Section 2.8 Radioactivity

50) The nuclear decay process that involves the particle having the greatest mass is _____ emission.

- A) alpha
- B) beta
- C) gamma
- D) positron

Answer: A

Topic: Section 2.8 Radioactivity

51) A beta particle is

- A) ${}_{-1}^0\text{e}$.
- B) ${}_{0}^{-1}\text{e}$.
- C) ${}_{1}^1\text{p}$.
- D) ${}_{2}^4\text{He}$.

Answer: A

Topic: Section 2.8 Radioactivity

52) When a substance decays by beta emission, the mass number of the nucleus _____ and the atomic number _____.

- A) decreases by 1, remains the same
- B) increases by 1, remains the same
- C) remains the same, decreases by 1
- D) remains the same, increases by 1

Answer: D

Topic: Section 2.8 Radioactivity

53) Beta decay of ${}^{24}\text{Na}$ produces a beta particle and

- A) ${}^{20}\text{F}$.
- B) ${}^{23}\text{Na}$.
- C) ${}^{24}\text{Ne}$.
- D) ${}^{24}\text{Mg}$.

Answer: D

Topic: Section 2.8 Radioactivity

Algo. Option: algorithmic

54) Which of the following statements about gamma radiation is **false**?

- A) It almost always accompanies alpha or beta emission.
- B) It is a mechanism to release excess energy in the nucleus.
- C) Gamma rays are high energy photons.
- D) The mass number decreases by one with each gamma emitted.

Answer: D

Topic: Section 2.8 Radioactivity

55) Gamma radiation can be described as

- A) a helium nucleus.
- B) a negatively charged free electron.
- C) high energy electromagnetic radiation.
- D) a positively charged free electron.

Answer: C

Topic: Section 2.8 Radioactivity

56) A positron is

- A) ${}^1_0\text{n}$.
- B) ${}^1_1\text{p}$.
- C) ${}^0_1\text{e}$.
- D) ${}^0_{-1}\text{e}$.

Answer: C

Topic: Section 2.8 Radioactivity

57) Positron emission changes the atomic number of an element by

- A) -2.
- B) -1.
- C) +1.
- D) +2.

Answer: B

Topic: Section 2.8 Radioactivity

58) Which of the following statements about positrons is **false**?

- A) The positron has same mass as an electron.
- B) A positron is ejected from the nucleus during the conversion of a proton into a neutron.
- C) A positron is a positive electron.
- D) When positron emission occurs, the atomic number of the nucleus increases.

Answer: D

Topic: Section 2.8 Radioactivity

59) Which of the following statements about electron capture is **false**?

- A) The electron is used to convert a proton to a neutron.
- B) The electron involved is most likely an outer shell valence electron .
- C) In electron capture decay, the atomic number decreases by one.
- D) In electron capture decay, the mass number remains unchanged.

Answer: B

Topic: Section 2.8 Radioactivity

60) Which one of the following processes does **not** result in transmutation to another element?

- A) alpha emission
- B) beta emission
- C) electron capture
- D) gamma emission

Answer: D

Topic: Section 2.8 Radioactivity

61) Which of the following decay processes give a product nuclide whose atomic number is one less than the starting nuclide?

- A) alpha decay
- B) beta decay and positron decay
- C) gamma decay and beta decay
- D) positron decay and electron capture

Answer: D

Topic: Section 2.8 Radioactivity

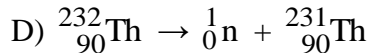
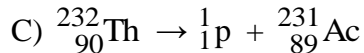
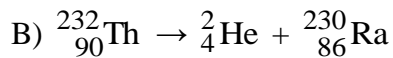
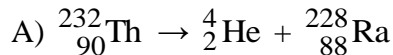
62) Which reaction below represents $^{15}_8\text{O}$ decay by positron emission?

- A) $^{15}_8\text{O} \rightarrow ^0_{-1}\text{e} + ^{15}_9\text{Ra}$
- B) $^{15}_8\text{O} \rightarrow ^0_1\text{e} + ^{15}_7\text{N}$
- C) $^{15}_8\text{O} \rightarrow ^{-1}_0\text{e} + ^{16}_8\text{O}$
- D) $^{15}_8\text{O} \rightarrow ^1_0\text{e} + ^{14}_8\text{O}$

Answer: B

Topic: Section 2.8 Radioactivity

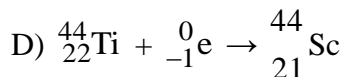
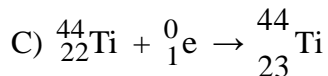
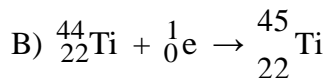
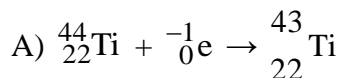
63) Which reaction below represents ${}^{232}_{90}\text{Th}$ decay by alpha emission?



Answer: A

Topic: Section 2.8 Radioactivity

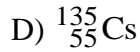
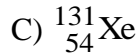
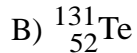
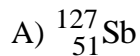
64) Which reaction below represents ${}^{44}_{22}\text{Ti}$ decay by electron capture?



Answer: D

Topic: Section 2.8 Radioactivity

65) In addition to a beta particle, what is the other product of beta decay of ${}^{131}_{53}\text{I}$?



Answer: C

Topic: Section 2.8 Radioactivity

Algo. Option: algorithmic

66) Tritium, ${}^3_1\text{H}$, is formed in the upper atmosphere when ${}^{14}_7\text{N}$ captures a neutron and then decays. What is the other product of this reaction?

- A) ${}^{13}_6\text{C}$
- B) ${}^{12}_6\text{C}$
- C) ${}^{12}_5\text{B}$
- D) ${}^{11}_5\text{B}$

Answer: B

Topic: Section 2.8 Radioactivity

67) When more than 3000 known nuclides are plotted on a neutron/proton grid they make up a group called

- A) the "island of stability."
- B) the "peninsula of nuclear stability."
- C) the "sea of instability."
- D) none of these

Answer: B

Topic: Section 2.9 Nuclear Stability

68) Which is the only element that contains more protons than neutrons in its most abundant stable isotope?

- A) boron
- B) carbon
- C) hydrogen
- D) mercury

Answer: C

Topic: Section 2.9 Nuclear Stability

69) As the atomic number of the elements increases, the ratio of neutrons to protons in stable nuclei

- A) decreases.
- B) stays the same.
- C) increases.
- D) is unrelated to stability.

Answer: C

Topic: Section 2.9 Nuclear Stability

70) Which one of the following statements about isotopes is **false**?

- A) The ratio of neutrons to protons is about 1:1 for elements lighter than Ca.
- B) The ratio of neutrons to protons is $> 1:1$ for elements heavier than Ca.
- C) Nonradioactive isotopes generally have an odd number of neutrons.
- D) All isotopes beyond ^{209}Bi are radioactive.

Answer: C

Topic: Section 2.9 Nuclear Stability

71) Which one of the following combinations of neutrons/protons results in the **lowest** number of nonradioactive (stable) isotopes?

- A) even number protons/even number neutrons
- B) even number protons/odd number neutrons
- C) odd number protons/even number neutrons
- D) odd number protons/odd number neutrons

Answer: D

Topic: Section 2.9 Nuclear Stability

72) Which of the following elements would you expect to have the **largest** number of stable isotopes? Element number:

- A) 48
- B) 49
- C) 50
- D) 51

Answer: C

Topic: Section 2.9 Nuclear Stability

73) Which of the following elements would be expected to be particularly stable?

- A) $^{40}_{20}\text{Ca}$
- B) $^{38}_{19}\text{K}$
- C) $^{39}_{18}\text{Ar}$
- D) $^{37}_{17}\text{Cl}$

Answer: A

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

74) Which process **decreases** the neutron/proton ratio?

- A) alpha emission
- B) beta emission
- C) electron capture
- D) positron emission

Answer: B

Topic: Section 2.9 Nuclear Stability

75) A radioisotope has a neutron/proton ratio which is too low. Which of the following processes will **not** occur for such a nucleus?

- A) alpha emission
- B) beta emission
- C) electron capture
- D) positron emission

Answer: B

Topic: Section 2.9 Nuclear Stability

76) A radioisotope which is neutron poor and very heavy is most likely to decay by

- A) alpha emission, electron capture, or positron emission.
- B) only alpha emission.
- C) only electron capture.
- D) only positron emission.

Answer: A

Topic: Section 2.9 Nuclear Stability

77) Which of the following nuclides is most likely to undergo beta decay?

- A) $^{190}_{80}\text{Hg}$
- B) $^{195}_{80}\text{Hg}$
- C) $^{200}_{80}\text{Hg}$
- D) $^{205}_{80}\text{Hg}$

Answer: D

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

78) Which of the following nuclides is most likely to decay by electron capture?

- A) $^{190}_{80}\text{Hg}$
- B) $^{195}_{80}\text{Hg}$
- C) $^{200}_{80}\text{Hg}$
- D) $^{205}_{80}\text{Hg}$

Answer: A

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

79) What nuclide is formed when $^{238}_{92}\text{U}$ undergoes a portion of the decay series: alpha, beta, beta, alpha, alpha, alpha.

- A) $^{226}_{88}\text{Ra}$
- B) $^{222}_{86}\text{Rn}$
- C) $^{230}_{90}\text{Th}$
- D) $^{206}_{82}\text{Pb}$

Answer: B

Topic: Section 2.9 Nuclear Stability

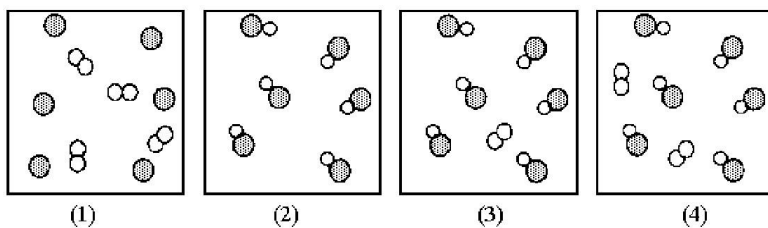
80) When $^{222}_{86}\text{Rn}$ decays in a 5-step series the product is $^{210}_{82}\text{Pb}$. How many alpha and beta particles are emitted in the decay series?

- A) 2 α , 3 β^-
- B) 3 α , 2 β^-
- C) 4 α , 1 β^-
- D) 1 α , 4 β^-

Answer: B

Topic: Section 2.9 Nuclear Stability

81) Assume that the mixture of substances in drawing (1) undergoes a chemical reaction. Which of the drawings (2)-(4) represents a product mixture that is consistent with the law of mass conservation?

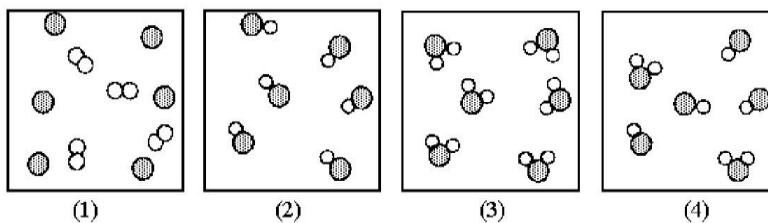


- A) drawing (2)
- B) drawing (3)
- C) drawing (4)

Answer: B

Topic: Key Concept Problems

82) Assume that the mixture of substances in drawing (1) undergoes a chemical reaction. Which of the drawings (2)-(4) represents a product mixture that is consistent with the law of mass conservation?

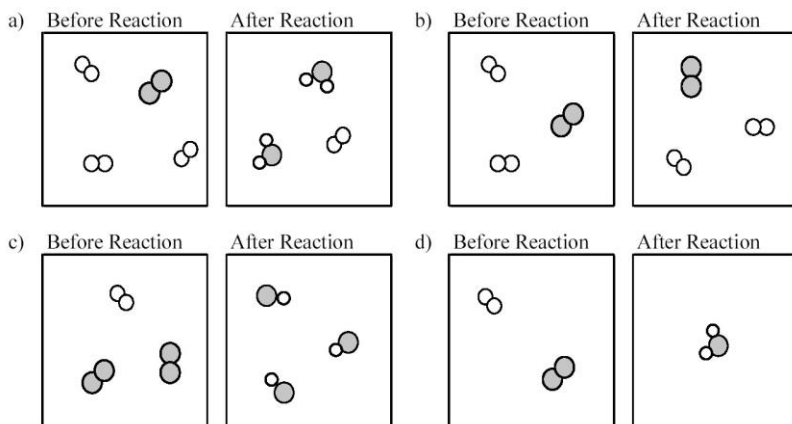


- A) drawing (2)
- B) drawing (3)
- C) drawing (4)

Answer: C

Topic: Key Concept Problems

83) Which of the following drawings depicts a chemical reaction consistent with Dalton's atomic theory?

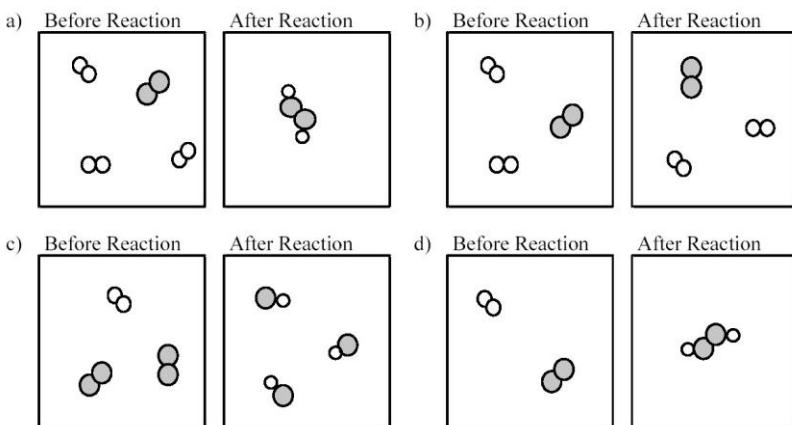


- A) drawing a)
- B) drawing b)
- C) drawing c)
- D) drawing d)

Answer: A

Topic: Key Concept Problems

84) Which of the following drawings depicts a chemical reaction consistent with Dalton's atomic theory?

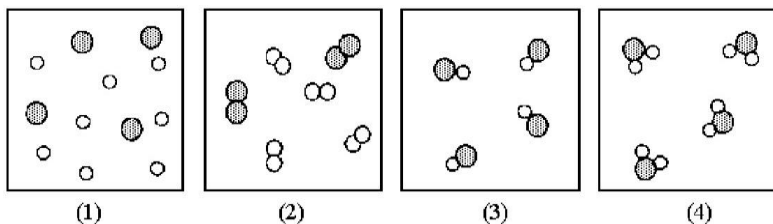


- A) drawing a)
- B) drawing b)
- C) drawing c)
- D) drawing d)

Answer: D

Topic: Key Concept Problems

85) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

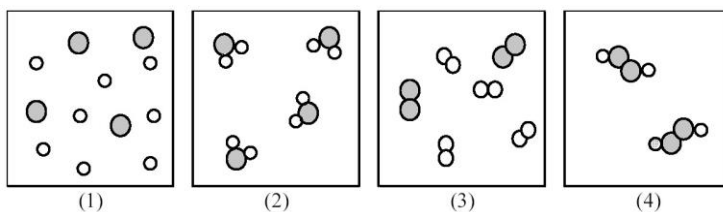


- A) only drawings (2) and (3)
- B) only drawings (2) and (4)
- C) only drawings (3) and (4)
- D) drawings (2), (3), and (4)

Answer: C

Topic: Key Concept Problems

86) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

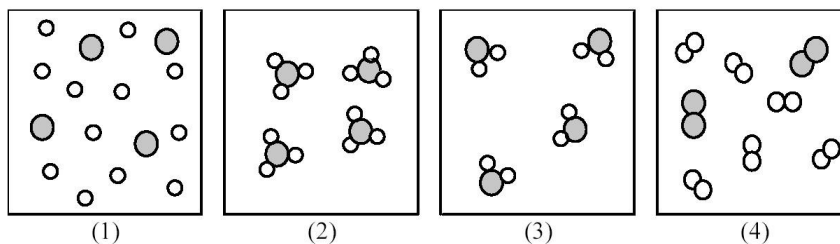


- A) only drawings (2) and (3)
- B) only drawings (2) and (4)
- C) only drawings (3) and (4)
- D) drawings (2), (3), and (4)

Answer: B

Topic: Key Concept Problems

87) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

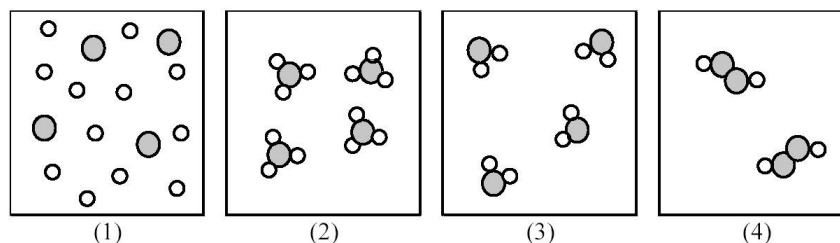


- A) only drawings (2) and (3)
- B) only drawings (2) and (4)
- C) only drawings (3) and (4)
- D) drawings (2), (3), and (4)

Answer: A

Topic: Key Concept Problems

88) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

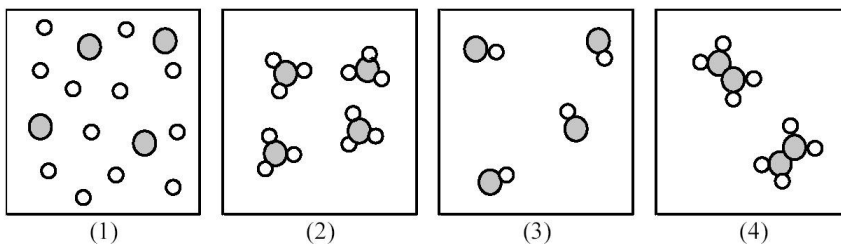


- A) only drawings (2) and (3)
- B) only drawings (2) and (4)
- C) only drawings (3) and (4)
- D) drawings (2), (3), and (4)

Answer: D

Topic: Key Concept Problems

89) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which combination of drawings (2)-(4) represent the law of multiple proportions?



- A) only drawings (2) and (3)
- B) only drawings (2) and (4)
- C) only drawings (3) and (4)
- D) drawings (2), (3), and (4)

Answer: D

Topic: Key Concept Problems

90) Which of the following figures represents ${}^3_1\text{H}$? Unshaded spheres represent neutrons and shaded spheres represent protons.

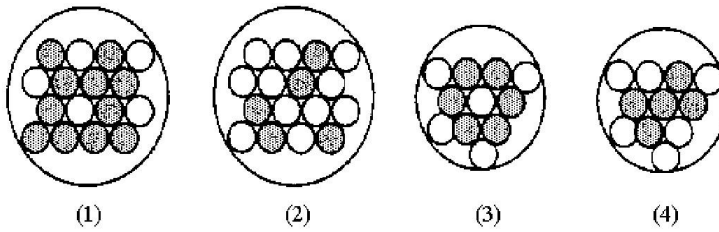


- A) figure (1)
- B) figure (2)
- C) figure (3)
- D) figure (4)

Answer: B

Topic: Key Concept Problems

91) Which of the following figures represents ${}^{11}_5\text{B}$? Unshaded spheres represent neutrons and shaded spheres represent protons.

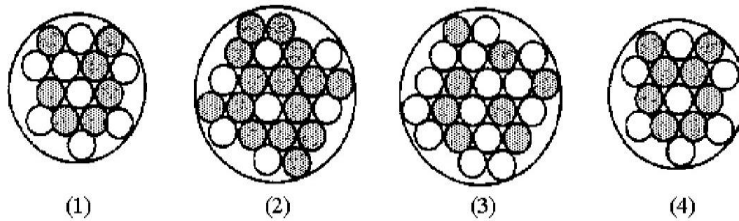


- A) figure (1)
- B) figure (2)
- C) figure (3)
- D) figure (4)

Answer: D

Topic: Key Concept Problems

92) Which of the following figures represents ${}^{15}_7\text{N}$? Unshaded spheres represent neutrons and shaded spheres represent protons.

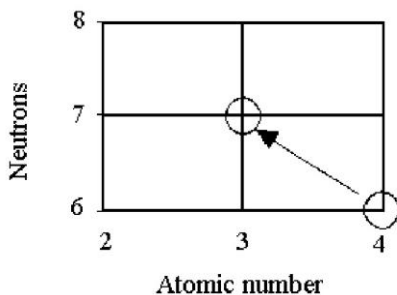


- A) figure (1)
- B) figure (2)
- C) figure (3)
- D) figure (4)

Answer: A

Topic: Key Concept Problems

93) Tell the type of decay process occurring in the following nuclear reaction.

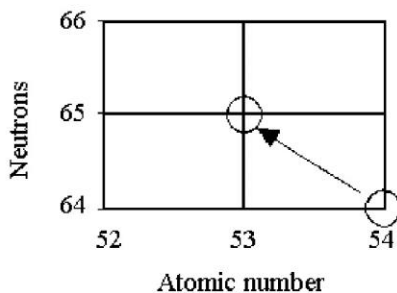


- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: D

Topic: Key Concept Problems

94) Tell the type of decay process occurring in the following nuclear reaction.

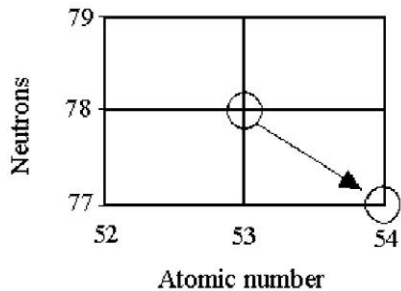


- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: D

Topic: Key Concept Problems

95) Tell the type of decay process occurring in the following nuclear reaction.

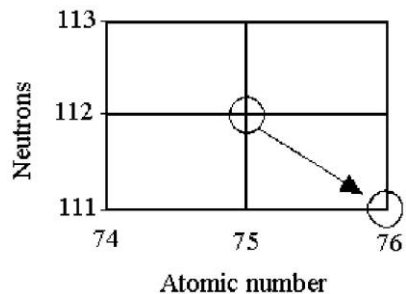


- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: B

Topic: Key Concept Problems

96) Tell the type of decay process occurring in the following nuclear reaction.

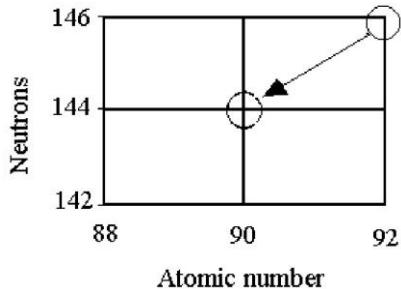


- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: B

Topic: Key Concept Problems

97) Tell the type of decay process occurring in the following nuclear reaction.

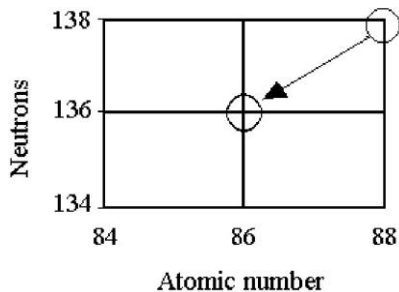


- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: A

Topic: Key Concept Problems

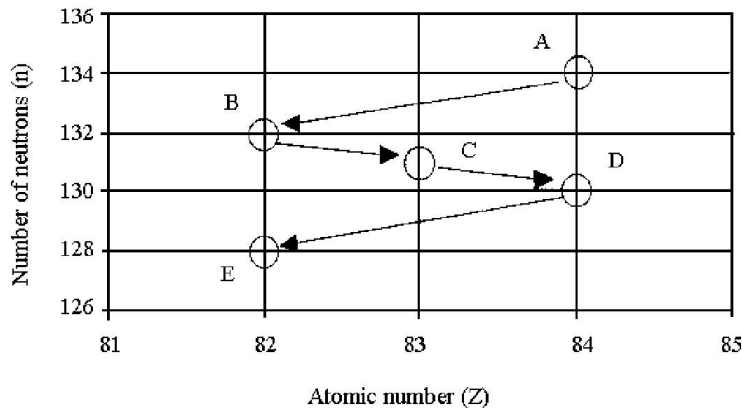
98) Tell the type of decay process occurring in the following nuclear reaction.



- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: A

Topic: Key Concept Problems



99) What kind of decay process is occurring in the decay of isotope A to isotope B in the figure shown above?

- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: A

Topic: Key Concept Problems

100) What kind of decay process is occurring in the decay of isotope B to isotope C in the figure shown above?

- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: B

Topic: Key Concept Problems

101) What kind of decay process is occurring in the decay of isotope C to isotope D in the figure shown above?

- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: B

Topic: Key Concept Problems

102) What kind of decay process is occurring in the decay of isotope D to isotope E in the figure shown above?

- A) α emission
- B) β emission
- C) γ emission
- D) electron capture or positron emission

Answer: A

Topic: Key Concept Problems

2.2 Algorithmic Questions

1) Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 3.2 g of methane reacts with 12.8 g of oxygen to produce 8.8 g of carbon dioxide?

- A) 7.2 g
- B) 8.8 g
- C) 14.8 g
- D) 16.0 g

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

2) Sodium metal and water react to form hydrogen and sodium hydroxide. If 1.99 g of sodium react with water to form 0.087 g of hydrogen and 3.47 g of sodium hydroxide, what mass of water was involved in the reaction?

- A) 1.56 g
- B) 1.99 g
- C) 3.38 g
- D) 3.55 g

Answer: A

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

3) A sample of pure lithium chloride contains 16.4% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?

- A) 8.20%
- B) 16.4%
- C) 32.8%
- D) 65.6%

Answer: B

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

4) A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 30.0 g of calcium fluoride?

- A) 1.71 g
- B) 7.70 g
- C) 15.0 g
- D) 15.4 g

Answer: D

Topic: Section 2.1 Conservation of Mass and the Law of Definite Proportions

Algo. Option: algorithmic

5) Elements A and Q form two compounds, AQ and A₂Q₃. The mass ratio (mass Q)/(mass A) for AQ is 0.286. What is the mass ratio (mass Q)/(mass A) for A₂Q₃?

- A) 0.191
- B) 0.429
- C) 2.33
- D) 5.24

Answer: B

Topic: Section 2.2 The Law of Multiple Proportions and Dalton's Atomic Theory

Algo. Option: algorithmic

6) Which are isotopes? An atom that has an atomic number of 34 and a mass number of 76 is an isotope of an atom that has

- A) an atomic number of 32 and a mass number of 76.
- B) an atomic number of 34 and a mass number of 80.
- C) 42 neutrons and 34 protons.
- D) 42 protons and 34 neutrons.

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

7) Which of the following represent isotopes?

A: ${}_{21}^{46}[\]$ B: ${}_{22}^{46}[\]$ C: ${}_{21}^{44}[\]$ D: ${}_{23}^{48}[\]$

- A) A and B
- B) A and C
- C) A and D
- D) C and D

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

8) How many protons (p) and neutrons (n) are in an atom of ${}_{43}^{98}\text{Tc}$?

- A) 43 p, 55 n
- B) 43 p, 98 n
- C) 55 p, 43 n
- D) 98 p, 43 n

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

9) How many protons (p) and neutrons (n) are in an atom of calcium-46?

- A) 20 p, 26 n
- B) 20 p, 46 n
- C) 26 p, 20 n
- D) 46 p, 20 n

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

10) What is the element symbol for an atom that has 33 protons and 41 neutrons?

- A) As
- B) Nb
- C) O
- D) W

Answer: A

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

11) How many electrons are in a neutral atom of iodine-131?

- A) 1
- B) 53
- C) 54
- D) 131

Answer: B

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

12) Identify the chemical symbol of element Q in ${}_{16}^{33}\text{Q}$.

- A) As
- B) Cl
- C) P
- D) S

Answer: D

Topic: Section 2.5 Atomic Numbers

Algo. Option: algorithmic

13) The number of nucleons in a ${}^{234}_{90}\text{Th}$ nucleus is

- A) 90.
- B) 144.
- C) 234.
- D) 324.

Answer: C

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

Algo. Option: algorithmic

14) Beta decay of ${}^{32}\text{P}$ produces a beta particle and

- A) ${}^{28}\text{Al}$.
- B) ${}^{31}\text{P}$.
- C) ${}^{32}\text{Si}$.
- D) ${}^{32}\text{S}$.

Answer: D

Topic: Section 2.8 Radioactivity

Algo. Option: algorithmic

15) In addition to a beta particle, what is the other product of beta decay of ${}^{131}_{53}\text{I}$?

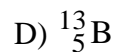
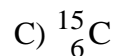
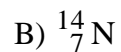
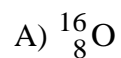
- A) ${}^{127}_{51}\text{Sb}$
- B) ${}^{131}_{52}\text{Te}$
- C) ${}^{131}_{54}\text{Xe}$
- D) ${}^{135}_{55}\text{Cs}$

Answer: C

Topic: Section 2.8 Radioactivity

Algo. Option: algorithmic

16) Which of the following elements would be expected to be particularly stable?

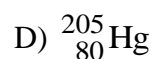
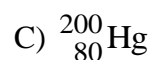
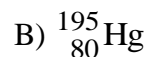
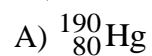


Answer: A

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

17) Which of the following nuclides is most likely to undergo beta decay?

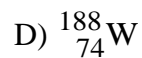
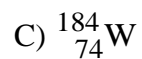
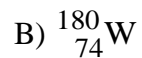
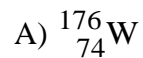


Answer: D

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

18) Which nuclide below is most likely to decay by electron capture?



Answer: A

Topic: Section 2.9 Nuclear Stability

Algo. Option: algorithmic

2.3 Short Answer Questions

1) Atoms of the same element always have the same number of _____ in their nuclei.

Answer: protons

Topic: Section 2.5 Atomic Numbers

2) Isotopes have the same number of _____ but different numbers of _____ in their nuclei.

Answer: protons, neutrons

Topic: Section 2.5 Atomic Numbers

3) The number of neutrons in a neutral atom of uranium-238 is _____.

Answer: 146

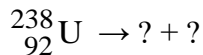
Topic: Section 2.5 Atomic Numbers

4) The number of protons, neutrons, and total nucleons in ${}_{44}^{106}\text{Ru}$ are _____, _____, and _____, respectively.

Answer: 44, 62, 106

Topic: Section 2.7 Nuclear Chemistry: The Change of One Element Into Another

5) ${}_{92}^{238}\text{U}$ undergoes alpha decay producing one alpha particle and a single nuclide. To balance the equation _____ and _____ must be added to the right side of the equation below.



Answer: ${}_{90}^{234}\text{Th}$, ${}_{2}^{4}\text{He}$

Topic: Section 2.8 Radioactivity