Essentials of General Organic and Biochemistry 3rd edition Guinn Test Bank

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Name:_____ Class:_____ Date:_____

Chapter 2 Atomic Structure and Radioisotopes

1. What is a micronutrient?
   a. an element required at only certain times during your life
   b. an essential element needed in quantities less than 10 g/day
   c. an essential element needed in quantities less than 100 mg/day
   d. a nonessential element, useful in small quantities
   e. nutrients needed in large quantities

ANSWER: c

2. What is a common symptom of iodine deficiency?
   a. weak bones and teeth
   b. enlarged thyroid
   c. anemia
   d. slow wound healing
   e. All of these are common symptoms.

ANSWER: b

3. _____ is an important component of hemoglobin. Without this protein, tissues become starved of oxygen, and fatigue and shortness of breath results.
   a. Iodine
   b. Fluorine
   c. Zinc
   d. Iron
   e. Oxygen

ANSWER: d

4. _____ is most commonly ingested along with salt.
   a. Iodine
   b. Fluorine
   c. Zinc
   d. Iron
   e. Oxygen

ANSWER: a

5. Adding _____ to drinking water is a common practice in many cities, meant to strengthen tooth enamel and decrease dental cavities.
   a. iodine
   b. fluorine
   c. zinc
   d. iron
   e. oxygen

ANSWER: b

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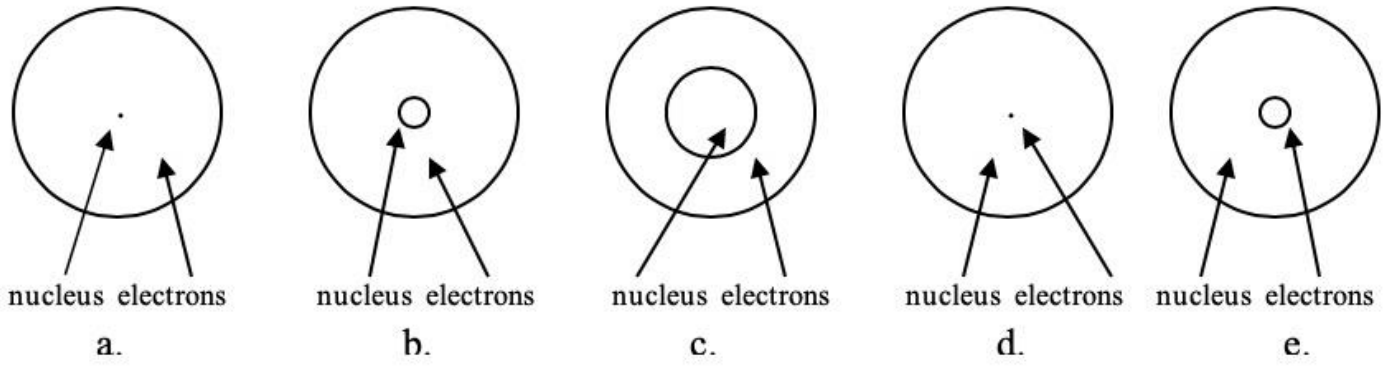
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Chapter 2 Atomic Structure and Radioisotopes

6. _____ is an important component of the immune system as well as required by many enzymes.
   a. Iodine
   b. Fluorine
   c. Zinc
   d. Iron
   e. Oxygen

ANSWER: c

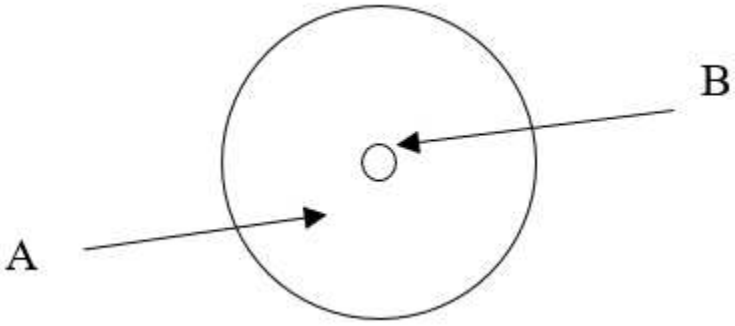
7. Which diagram of an atom BEST represents the scale of the nucleus and electrons?



   a. a.
   b. b.
   c. c.
   d. d.
   e. e.

ANSWER: a

8. According to the current model of the atom, the part of the diagram labeled A is made up of



   a. protons.
   b. neutrons.
   c. electrons.
   d. protons and neutrons.

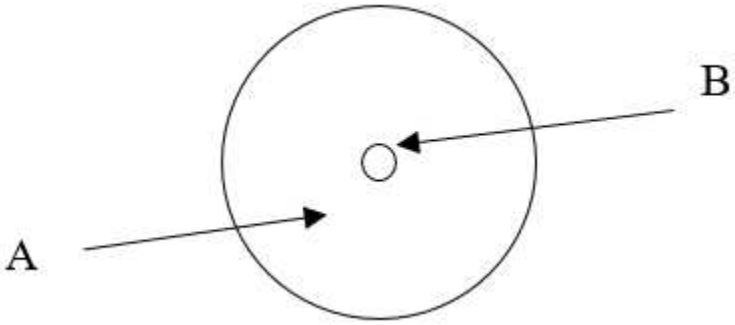
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e. protons, neutrons, and electrons.

ANSWER: c

9. According to the current model of the atom, the part of the diagram labeled B is made up of



a. protons.
b. neutrons.
c. electrons.
d. protons and neutrons.
e. protons, neutrons, and electrons.

ANSWER: d

10. Which statement about the model of the atom is TRUE?
a. The nucleus is much less dense than the surrounding electrons.
b. Electrons orbit the nucleus like planets around the Sun.
c. This is the first model of the atom.
d. The atom is mostly empty space.
e. The model of the atom was developed by looking directly at an atom.

ANSWER: d

11. Which statement about the model of the atom is TRUE?
a. Protons and neutrons are evenly distributed throughout the atom.
b. Electrons can be directly observed.
c. Electrons are now known to orbit the nucleus like a planet orbits the Sun.
d. The path of a single electron can now be followed exactly.
e. We can determine the probability of finding an electron in a region of space.

ANSWER: e

12. The nucleus is composed of _____.
a. protons
b. neutrons
c. electrons
d. protons and neutrons

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e. protons, neutrons, and electrons

ANSWER: d

13. _____ have a negative charge.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

ANSWER: c

14. _____ have a positive charge.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

ANSWER: a

15. _____ are neutral.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

ANSWER: b

16. _____ are the subatomic particles that have the smallest mass.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

ANSWER: c

17. _____ have a mass of approximately 1 amu.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

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ANSWER: d

18. The identity of an element is determined by its number of _____.
    a. protons
    b. neutrons
    c. electrons
    d. protons and neutrons
    e. protons, neutrons, and electrons

ANSWER: a

19. Which pair correctly matches an element to its atomic number?
    a. 9.012 – Be
    b. 12.01 – C
    c. 39.94 – Ar
    d. 9 – F
    e. 133 – Cs

ANSWER: d

20. Which pair does NOT correctly match an element symbol to its full name?
    a. C – carbon
    b. O – oxygen
    c. H – helium
    d. N – nitrogen
    e. Cl – chlorine

ANSWER: c

21. Isotopes are elements with the same number of
    a. electrons but different numbers of protons.
    b. protons but different numbers of electrons.
    c. electrons but different numbers of neutrons.
    d. protons but different numbers of neutrons.
    e. neutrons but different numbers of protons.

ANSWER: d

22. Which of the following is NOT true for the atoms ^{12}C, ^{13}C, and ^{14}C?
    a. They all have six electrons.
    b. They all have the same mass number.
    c. They all have the same atomic number.
    d. They are isotopes.
    e. They all have six protons.

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ANSWER: b

23. Radioactive isotopes are
    a. very stable isotopes.
    b. highly chemically reactive.
    c. unstable isotopes.
    d. charged species.
    e. unusually nonreactive.

ANSWER: c

24. Select the choice in which atomic number, mass number, number of neutrons, and number of protons listed is correct for phosphorous-32.

	Atomic number	Mass number	Number of neutrons	Number of protons
a.	15	32	32	15
b.	15	32	17	15
c.	17	15	15	17
d.	17	32	32	17
e.	16	32	16	16

    a. choice a
    b. choice b
    c. choice c
    d. choice d
    e. choice e

ANSWER: b

25. Which of the following elements exists as an isotope with a mass number of 35 and an atomic number of 17?
    a. chlorine
    b. bromine
    c. argon
    d. tellurium
    e. sulfur-35

ANSWER: a

26. Which of the following is NOT the same for different isotopes of the same element?
    a. atomic number
    b. number of protons
    c. number of electrons

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d. charge
e. mass number

ANSWER: e

27. Which isotope of zirconium is the lightest?

	Isotope	Natural abundance
A	^{90}Zr	52%
B	^{91}Zr	11%
C	^{92}Zr	17%
D	^{94}Zr	17%
E	^{96}Zr	3%

a. choice A
b. choice B
c. choice C
d. choice D
e. choice E

ANSWER: a

28. Which isotope of zirconium is the LEAST abundant?

	Isotope	Natural abundance
A	^{90}Zr	52%
B	^{91}Zr	11%
C	^{92}Zr	17%
D	^{94}Zr	17%
E	^{96}Zr	3%

a. choice A
b. choice B
c. choice C
d. choice D
e. choice E

ANSWER: e

29. Which isotope of Zirconium has the fewest number of neutrons?

	Isotope	Natural abundance
A	^{90}Zr	52%
B	^{91}Zr	11%

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C	^{92}Zr	17%
D	^{94}Zr	17%
E	^{96}Zr	3%

a. choice A
b. choice B
c. choice C
d. choice D
e. choice E

ANSWER: a

30. The average atomic mass of zirconium is

	Isotope	Natural abundance
A	^{90}Zr	52%
B	^{91}Zr	11%
C	^{92}Zr	17%
D	^{94}Zr	17%
E	^{96}Zr	3%

a. less than 90 because the atomic mass only depends on the number of protons in the atom.
b. 90 because ^{90}Zn has the highest natural abundance.
c. greater than 90 but less than 96 because the atomic mass takes into account the abundance of all naturally occurring isotopes.
d. 96 because the atomic mass is the mass of the highest naturally occurring isotope.
e. greater than 96 because the atomic mass is the sum of masses of the naturally occurring isotopes.

ANSWER: c

31. Which of the following statements about isotopes is FALSE?
a. Isotopes are atoms with the same number of protons but different numbers of neutrons.
b. Most elements naturally have more than one isotope.
c. Isotopes are atoms with the same atomic number but different mass numbers.
d. An isotope with more neutrons will have a greater mass than an isotope with fewer neutrons.
e. Isotopes are present in equal quantities.

ANSWER: e

32. An atom of carbon containing seven neutrons can be written as

^{13}C	^{12}C	carbon-13	carbon-12	C-12	C-14
I	**II**	**III**	**IV**	**V**	**VI**

a. All of the choices are correct for writing carbon.

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b. II, IV, or V.
c. I, III.
d. I, II.
e. III, IV.

ANSWER: c

33. What is the mass number of an atom of oxygen with seven neutrons?
a. 1
b. 7
c. 8
d. 15
e. 15.9994

ANSWER: d

34. According to the periodic table, what types of elements are in group 7A?
a. transition metals
b. noble gases
c. alkaline earth metals
d. alkali metals
e. halogens

ANSWER: e

35. According to the periodic table, what types of elements are in group 8A?
a. transition metals
b. noble gases
c. alkaline earth metals
d. alkali metals
e. halogens

ANSWER: b

36. According to the periodic table, what types of elements are in group 1A?
a. transition metals
b. noble gases
c. alkaline earth metals
d. alkali metals
e. halogens

ANSWER: d

37. According to the periodic table, what types of elements are in group 2A?
a. transition metals
b. noble gases

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c. alkaline earth metals
d. alkali metals
e. halogens

ANSWER: c

38. The elements numbered 21 through 30 are examples of _____.
a. transition metals
b. noble gases
c. alkali earth metals
d. alkali metals
e. halogens

ANSWER: a

39. The periods are the _____ of the periodic table.
a. transition metals
b. halogens
c. rows
d. columns
e. numbers

ANSWER: c

40. The groups are the _____ of the periodic table.
a. transition metals
b. halogens
c. rows
d. columns
e. numbers

ANSWER: d

41. According to the periodic table, the atomic number of potassium (K) is _____.
a. 4
b. 19
c. 39.10
d. K
e. 2

ANSWER: b

42. According to the periodic table, the atomic mass of potassium (K) is _____.
a. 4
b. 19
c. 39.10

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d. K
e. 2

ANSWER: c

43. According to the periodic table, which element is in period 4, group 6A?
a. Cr
b. La
c. Ga
d. Se
e. Al

ANSWER: d

44. According to the periodic table, which element is found in period 2, group 5A?
a. nitrogen
b. vanadium
c. strontium
d. boron
e. cadmium

ANSWER: a

45. According to the periodic table, which of the following sets of terms accurately describes chlorine?

Metal	Halogen	Alkaline earth element	Atomic number 35
I	**II**	**III**	**IV**

a. I only
b. II only
c. I and II
d. II and IV
e. III and IV

ANSWER: b

46. According to the periodic table, which of the following sets of terms accurately describes potassium?

Nonmetal	Halogen	Alkali metal	Group 2A
I	**II**	**III**	**IV**

a. I only
b. III only
c. I and II
d. II and IV
e. III and IV

ANSWER: b

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47. An element is a solid at room temperature and a shiny, metallic gray. However, it is a poor conductor of electricity and temperature, and it is also brittle. Which element fits this description?

a. oxygen
b. lithium
c. helium
d. antimony
e. iron

ANSWER: d

48. Which of the following terms is NOT a characteristic of a metal?

a. malleable
b. a good conductor of heat
c. a good conductor of electricity
d. shiny
e. a gas at room temperature

ANSWER: e

49. The number of protons is equal to the _____ in a neutral atom.

a. number of neutrons
b. number of electrons
c. mass number
d. average atomic mass
e. group number

ANSWER: b

50. What is the atomic number of element X?

$^{56}_{25}X$

a. 25
b. 56
c. 81
d. 31
e. None of the above values is the atomic number.

ANSWER: a

51. What is the mass number of element X?

$^{56}_{25}X$

a. 25
b. 56
c. 81

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d. 31
e. None of the above values is the mass number.

ANSWER: b

52. How many electrons are in a neutral atom of element X?

$^{56}_{25}X$

a. 25
b. 56
c. 81
d. 31
e. None of the above values is the number of electrons.

ANSWER: a

53. What is the identity of element X?

$^{56}_{25}X$

a. xenon
b. manganese
c. gold
d. copper
e. iron

ANSWER: b

54. _____ make up the majority of compounds found in living organisms.
a. Building-block elements
b. Macronutrients
c. Micronutrients
d. Metals
e. Metalloids

ANSWER: a

55. Most of the micronutrients are
a. transition metals.
b. metalloids.
c. nonmetals.
d. alkali earth metals.
e. noble gases.

ANSWER: a

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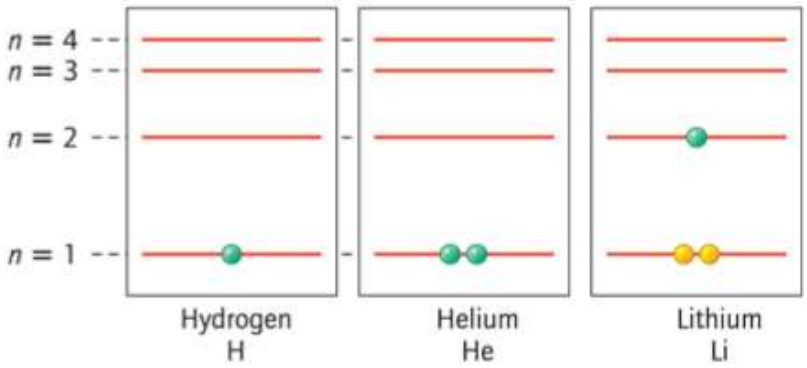
56. Micro- and macronutrients are
    a. equally distributed throughout the body.
    b. all metals and metalloids.
    c. obtained through the diet.
    d. only found in the first three periods of the periodic table.
    e. all required in quantities of more than 100 mg per day.

ANSWER: c

57. Which of the following is NOT a building block element?
    a. C
    b. H
    c. O
    d. N
    e. These are all building block elements.

ANSWER: e

58. Which atom has the largest diameter?



    a. H
    b. He
    c. H and He
    d. Li
    e. All of the above have the same diameter.

ANSWER: d

59. _____ determine the physical and chemical characteristics of an atom.
    a. Protons
    b. Neutrons
    c. Electrons
    d. Protons and neutrons
    e. Protons, neutrons, and electrons

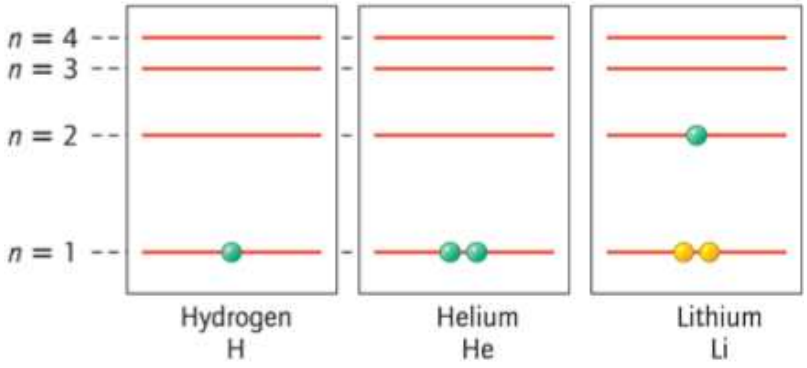
ANSWER: c

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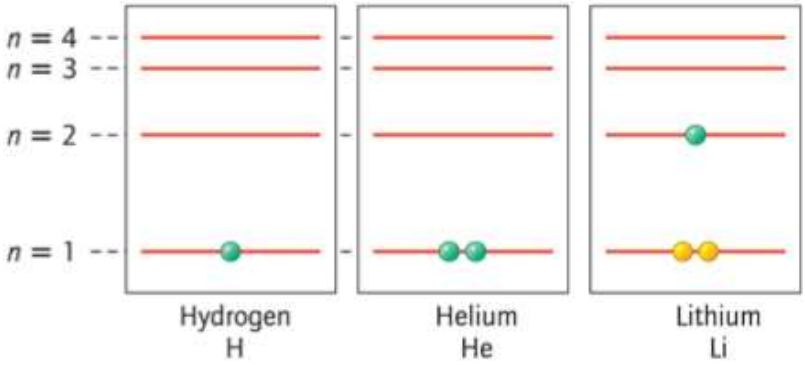
60. Which electron energy level is closest to the nucleus of the atom?



a. $n = 1$
b. $n = 2$
c. $n = 3$
d. $n = 4$
e. All electrons are equally close to the nucleus.

ANSWER: a

61. Which electron energy level is lowest in energy?



a. $n = 1$
b. $n = 2$
c. $n = 3$
d. $n = 4$
e. All electrons are equal in energy.

ANSWER: a

62. According to the periodic table, how many energy levels do the elements in the third row have?
a. 1
b. 2
c. 3
d. 4

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e. It depends on the specific element.

ANSWER: c

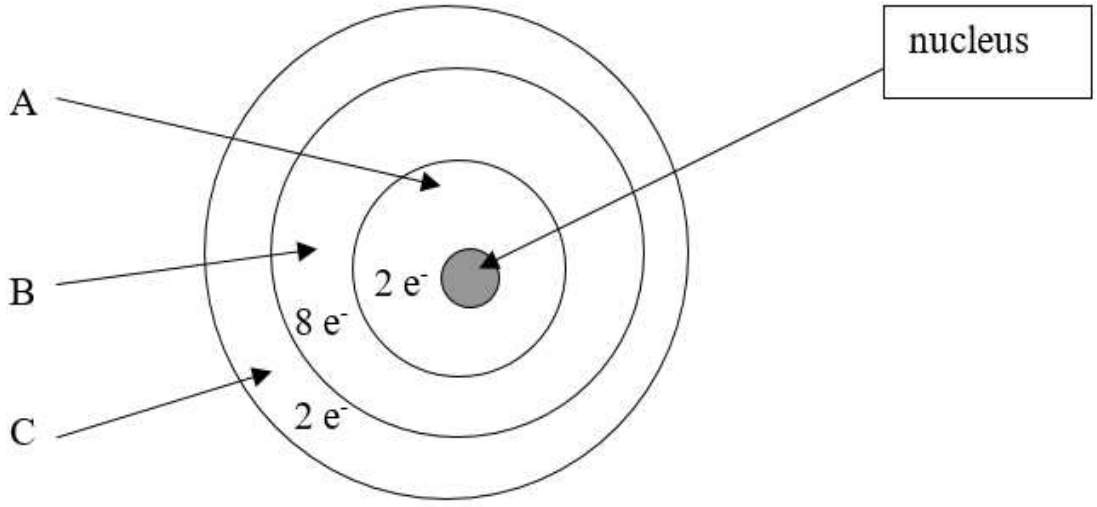
63. According to the periodic table, how many valence electrons do the elements in the third row have?
    a. 3
    b. 4
    c. 5
    d. 8
    e. It depends on the specific element.

ANSWER: e

64. According to the periodic table, how many valence electrons do the elements in group 7A have?
    a. 5
    b. 6
    c. 7
    d. 8
    e. It depends on the specific element.

ANSWER: c

65. Which element is depicted in this drawing of a neutral atom?



    a. beryllium
    b. magnesium
    c. oxygen
    d. neon
    e. calcium

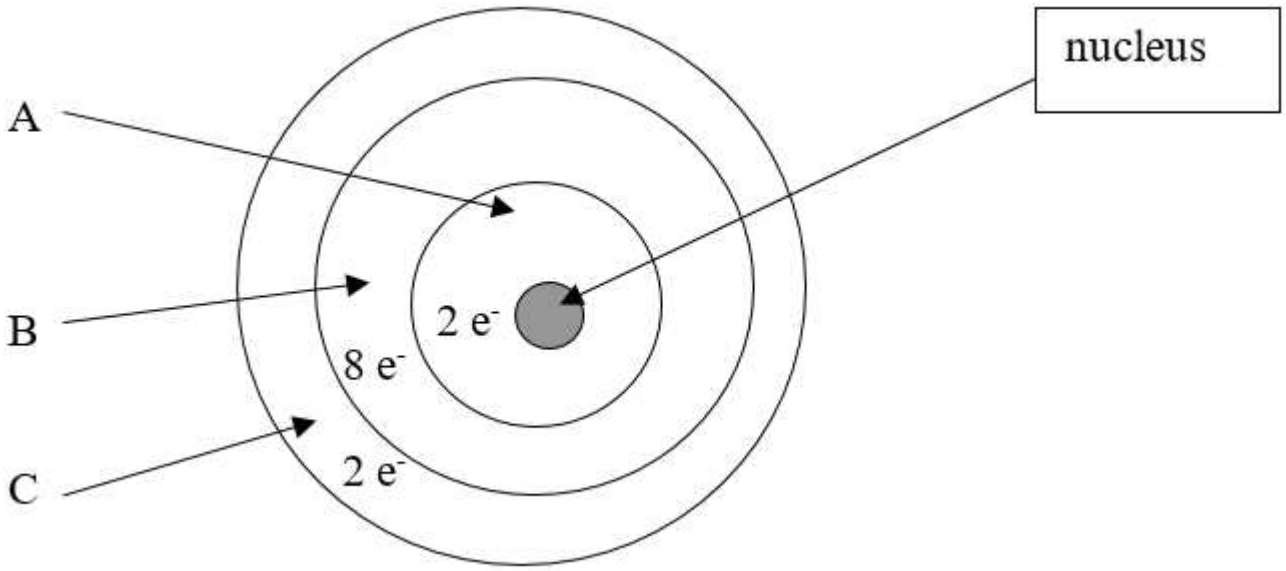
ANSWER: b

66. Which energy level is the valence energy level?

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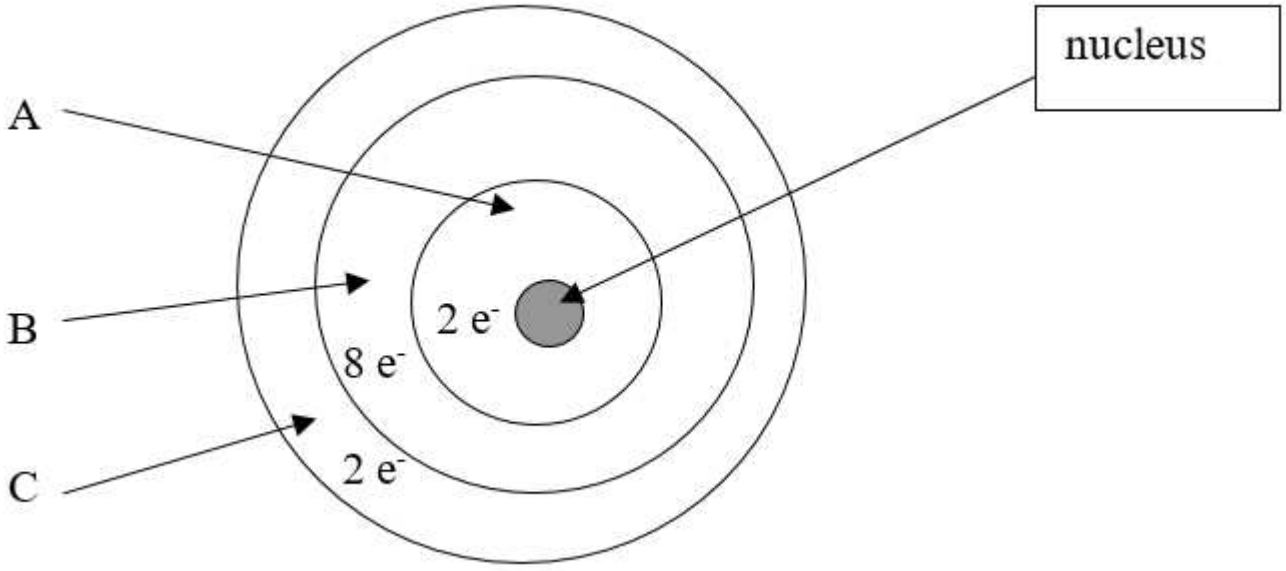
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a. energy level A
b. energy level B
c. energy level C
d. energy levels A and B
e. energy levels B and C

ANSWER: c

67. How many electrons are in the valence energy level?



a. 12
b. 10
c. 8

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d. 4

e. 2

ANSWER: e

68. The element chlorine has three electron energy levels. How many electrons are in each level?

	$n = 1$	$n = 2$	$n = 3$
a.	2	8	8
b.	2	8	18
c.	7	8	2
d.	2	8	7
e.	8	8	1

a. choice a

b. choice b

c. choice c

d. choice d

e. choice e

ANSWER: d

69. Electron energy levels closest to the nucleus are occupied before electron energy levels farther from the nucleus because the electron energy levels closest to the nucleus are

a. pulled toward the nucleus by gravity.

b. protected by the outer shell.

c. attracted to the nucleus for reasons unknown.

d. more stable than electrons farther from the nucleus.

e. Actually, electrons farther from the nucleus are filled first.

ANSWER: d

70. The size of atoms generally increases as the number of

a. electron energy levels increases.

b. electrons in the valence energy level increases.

c. neutrons in atoms increases.

d. protons increases.

e. All atoms are the same size.

ANSWER: a

71. Which element would you expect to be the largest?

a. fluorine

b. chlorine

c. argon

d. calcium

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e. hydrogen

ANSWER: d

72. Radioactive decay is the process by which
a. radioisotopes become more stable.
b. radioisotopes emit radiation.
c. radioisotopes emit high-energy particles and/or electromagnetic radiation.
d. an element of one type can change to an element of another type.
e. All of the above are correct about radioactive decay.

ANSWER: e

73. The process in which a nucleus spontaneously breaks down by emitting radiation is known as
a. fusion.
b. fission.
c. a chain reaction.
d. reaction.
e. radioactive decay.

ANSWER: e

74. The symbol $^{4}_{2}\alpha$ is used to represent a(n)
a. proton.
b. alpha particle.
c. gamma ray.
d. beta particle.
e. neutron.

ANSWER: b

75. How is an alpha particle different from an atom of helium?
a. It's not different at all.
b. It has a different number of protons.
c. It has a different number of neutrons.
d. It has a different number of electrons.
e. It has both a different number of electrons and a different number of protons.

ANSWER: d

76. The radioisotope undergoing decay is often called the
a. reactant.
b. product.
c. parent nuclide.
d. decayer.

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e. daughter nuclide.

ANSWER: c

77. A nuclear equation is balanced when the _____ is equal on both sides of the equation.
a. identity of the atoms
b. charges on the atoms
c. identity of the radioactive particles
d. sum of the atomic numbers
e. sum of the atomic and mass numbers

ANSWER: e

78. What type of radiation is emitted when U-235 undergoes radioactive decay?
$^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + ?$
a. alpha particle
b. beta particle
c. positron
d. gamma ray
e. x-ray

ANSWER: a

79. Which of the following indicates that an alpha particle has been released during radioactive decay of an atom?
a. The identity of the atom does not change.
b. The mass number of the atom decreases by 4.
c. The atomic number of the atom increases by 1
d. The atomic number of the atom decreases by 1.
e. The atomic number of the atom decreases by 4.

ANSWER: b

80. In which of the following reactions is the missing particle an alpha particle?
a. $^{137m}_{56}\text{Ba} \rightarrow {}^{137}_{56}\text{Ba} + ?$
b. $^{13}_{7}\text{N} \rightarrow {}^{13}_{6}\text{C} + ?$
c. $^{141}_{58}\text{Ce} \rightarrow {}^{141}_{59}\text{Pr} + ?$
d. $^{232}_{90}\text{Th} \rightarrow {}^{228}_{88}\text{Ra} + ?$
e. All of these are examples of alpha decay.

ANSWER: d

81. The product from the alpha decay of radon-222 is
a. polonium-218.

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b. radium-226.
c. polonium-226.
d. radium-218.
e. lead-220.

ANSWER: a

82. How is a beta particle different from an electron?
a. They are the same.
b. A beta particle has higher energy than a regular electron
c. A regular electron has higher energy than a beta particle.
d. A beta particle is positively charged.
e. A beta particle is positively charged and higher in energy than a regular electron.

ANSWER: b

83. Which nuclear reaction releases a beta particle?
a. $^{137m}_{56}\text{Ba} \rightarrow {}^{137}_{56}\text{Ba} + ?$
b. $^{13}_{7}\text{N} \rightarrow {}^{13}_{6}\text{C} + ?$
c. $^{141}_{58}\text{Ce} \rightarrow {}^{141}_{59}\text{Pr} + ?$
d. $^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + ?$
e. All of these are examples of beta decay.

ANSWER: c

84. In a balanced nuclear reaction, which statement is consistent with the release of a beta particle?
a. The identity of the atom does not change.
b. All radioactive decay releases a beta particle.
c. The mass number decreases by 4.
d. The atomic number increases by 1.
e. The atomic number decreases by 1.

ANSWER: d

85. What is the identity of the missing daughter nuclide in the following nuclear reaction?
$^{12}_{5}\text{B} \rightarrow ? + {}^{0}_{-1}\beta$
a. beryllium-11
b. beryllium-12
c. beryllium-13
d. carbon-12
e. carbon-13

ANSWER: d

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86. The time that it takes a macroscopic sample of a radioisotope to decay to one-half its original activity is known as the
   a. reaction rate.
   b. kinetics.
   c. half-life.
   d. lifetime.
   e. decay rate.

ANSWER: c

87. Radioisotopes used in medicine typically have short half-lives. Which of the following statements BEST describes the reason for this?
   a. It minimizes the harmful side effects of the radiation.
   b. They are the isotopes that are the easiest to make.
   c. These radioisotopes occur naturally.
   d. Only small amounts of them are required.
   e. These radioisotopes emit the correct type of radioactive particle.

ANSWER: a

88. Which of the following radioisotope would be LEAST likely to be used in a medical application?
   a. barium-131 (half-life = 11.6 days)
   b. iodine-131 (half-life = 8 days)
   c. technecium-99m (half-life = 6 hours)
   d. plutonium-239 (half-life = 2.4×10^4 years)
   e. fluorine-18 (109 minutes)

ANSWER: d

89. Technetium-99m is used in a variety of medical applications. It has a half-life of 6 hours. If 100.0 mg of technetium-99m is prepared at 6:00 AM, how many milligrams are still active when it is needed for diagnostic testing at 6:00 PM?
   a. 100.0 mg
   b. 50.0 mg
   c. 25.0 mg
   d. 10.0 mg
   e. 5.00 mg

ANSWER: c

90. Iodine-131 has a half-life of 8 days. How many half-lives have passed after 24 days?
   a. 1 half-life
   b. 2 half-lives
   c. 3 half-lives
   d. 4 half-lives

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e. 5 half-lives

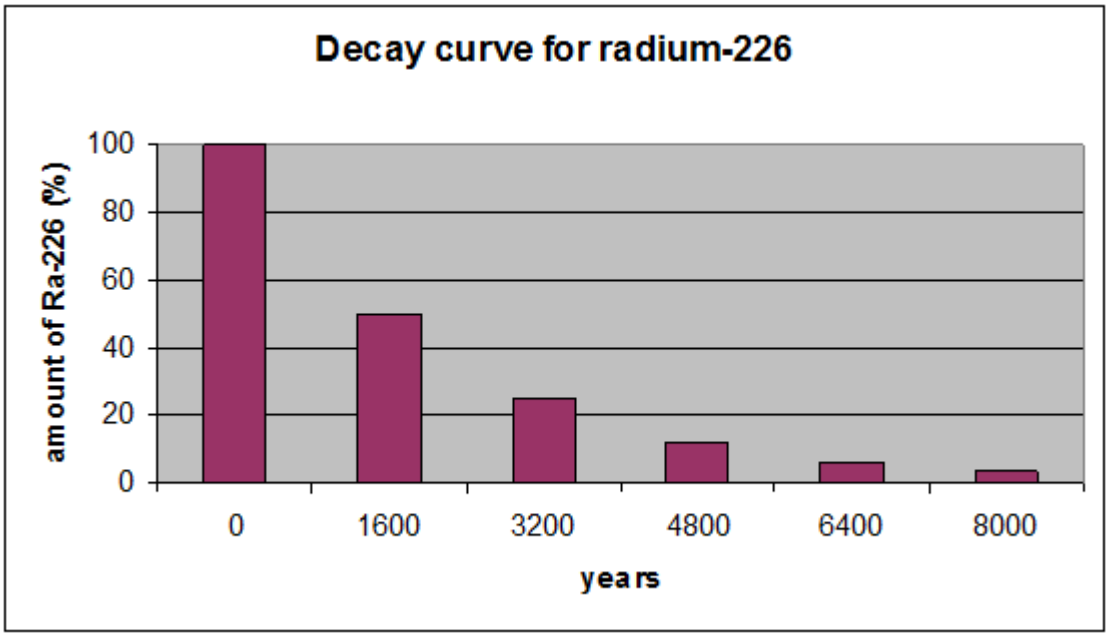
ANSWER: c

91. Carbon-11 has a half-life of 20 minutes. Which of the following equations is used to calculate the amount of carbon-11 remaining after 1 hour if the starting material is a 100-mg sample?

a. 100 mg × ½
b. 100 mg/3
c. 100 mg/20
d. 100 mg/20/20/20
e. 100 mg × ½ × ½ × ½

ANSWER: e

92. According to the graph, what is the half-life in years of ^{226}Ra?



a. 8,000 years
b. 6,400 years
c. 4,800 years
d. 3,200 years
e. 1,600 years

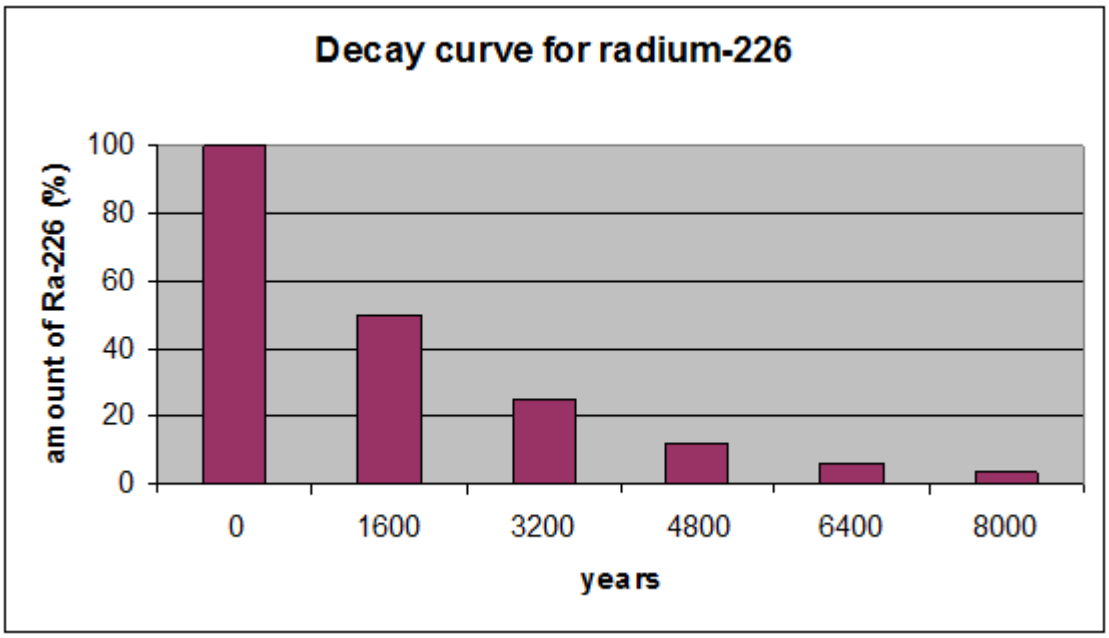
ANSWER: e

93. According the graph, what percent of radium-226 remains after three half-lives?

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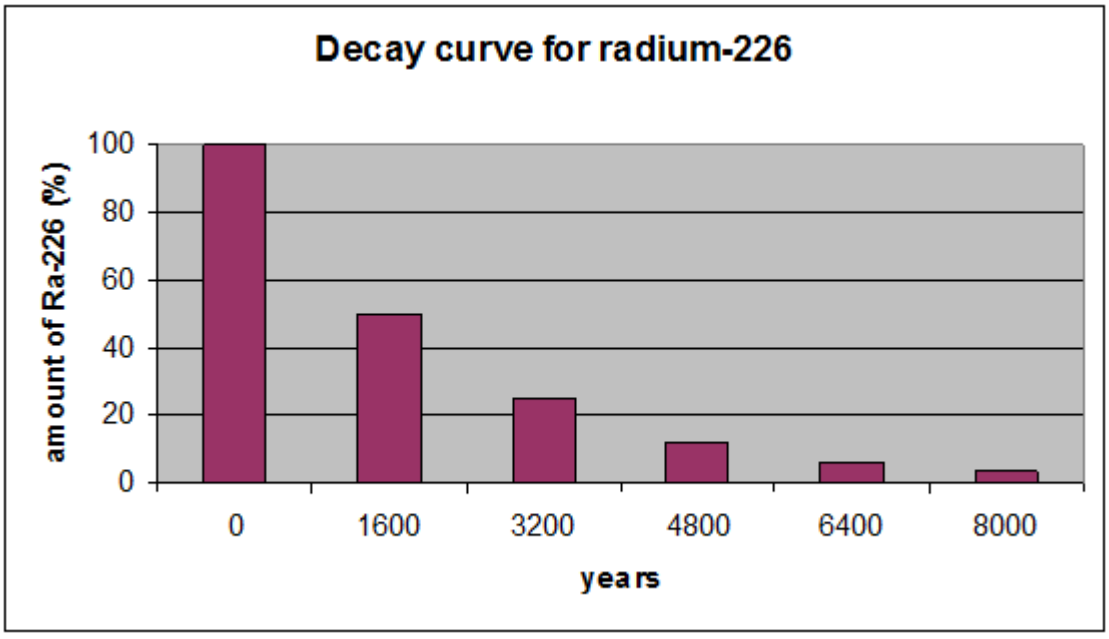
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a. 100%
b. 50%
c. 25%
d. 12.5%
e. 6.25%

ANSWER: d

94. According to the graph, radioactive decay is a(n) _____ in radioactivity as a function of time.



a. linear decrease

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b. linear increase
c. exponential decrease
d. exponential increase
e. random decrease

ANSWER: c

95. Phosphorous-32 is a beta emitter with a half-life of 14.3 days. After 42 days, a 100-mg sample will have decayed to 25 mg. Which statement BEST describes where the rest of the ^{32}P went?
a. It disappeared.
b. It reacted with air.
c. It turned into sulfur and a beta particle.
d. It turned into silicon and a beta particle.
e. It decomposed into beta particles.

ANSWER: c

96. An atom in a metastable state is
a. unusually low in energy.
b. unusually stable.
c. very unreactive.
d. high in energy.
e. emittable.

ANSWER: d

97. Which of the following is NOT a type of radiation that comes from the decay of radioisotopes?
a. microwaves
b. gamma rays
c. alpha particle
d. beta particle

ANSWER: a

98. What fraction of the electromagnetic spectrum is visible to humans?
a. about two-thirds
b. half
c. about one-quarter
d. a very small fraction
e. none

ANSWER: d

99. Which of the following colors has the lowest energy?
a. red
b. orange

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c. yellow
d. green
e. blue

ANSWER: a

100. What is the relationship between the energy and the wavelength of light?
a. They are proportional.
b. They are inversely proportional.
c. As one increases, so does the other, but not in a linear way.
d. As one increases, the other decreases, but not in a predictable way.
e. They are unrelated in any way.

ANSWER: b

101. Which of the following changes when gamma radiation is released?
a. atomic number
b. number of protons
c. number of electrons
d. number of neutrons
e. energy of the isotope

ANSWER: e

102. In which of the following nuclear reactions is only gamma radiation released?
a. $^{137m}_{56}\text{Ba} \rightarrow {}^{137}_{56}\text{Ba} + ?$
b. $^{13}_{7}\text{N} \rightarrow {}^{13}_{6}\text{C} + ?$
c. $^{141}_{58}\text{Ce} \rightarrow {}^{141}_{59}\text{Pr} + ?$
d. $^{235}_{92}\text{U} \rightarrow {}^{231}_{90}\text{Th} + ?$
e. All of these reactions probably release gamma radiation.

ANSWER: a

103. In a balanced nuclear reaction, which of the following is consistent with the release of a gamma particle?
a. The identity of the atom does not change.
b. All radioactive decay releases gamma radiation.
c. The mass number decreases by 4.
d. The atomic number increases by 1.
e. The atomic number decreases by 1.

ANSWER: a

104. What is the most penetrating electromagnetic radiation?
a. radio waves

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b. microwaves
c. gamma rays
d. visible light
e. ultraviolet rays

ANSWER: c

105. Which is the BEST definition of the term "ionizing radiation"?
a. This is radiation that has enough energy to dislodge a valence electron from an atom.
b. This is the radiation that is released during a nuclear reaction.
c. This is any electromagnetic radiation.
d. This is any nuclear or electromagnetic radiation.
e. This is any long-wavelength electromagnetic radiation.

ANSWER: a

106. How is an atom in the body changed once it is hit with ionizing radiation?
a. It becomes positively charged.
b. It becomes negatively charged.
c. It becomes a new isotope.
d. It becomes a new element.
e. It falls apart.

ANSWER: a

107. How is ionizing radiation damaging to the body?
a. It can cause DNA damage.
b. It can cause gene mutations.
c. It can cause cell death.
d. It can cause radiation sickness.
e. All of the above are correct about ionizing radiation damage to the body.

ANSWER: e

108. Which of the following types of radiation can be stopped by light clothing?
a. beta particles
b. alpha particles
c. gamma rays
d. x-rays
e. All of the above radiation can be stopped by light clothing.

ANSWER: b

109. Which statement BEST describes why alpha particles are not frequently used in medical applications?
a. Their half-lives are too long.
b. They can do too much damage at close range.

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c. They are difficult to transport.
d. They require too much shielding.
e. Their penetrating power is too great.

ANSWER: b

110. What sort of protection should be used when working with gamma emitters?
a. a lead shield
b. heavy clothing
c. a sheet of aluminum
d. a very thick slab of concrete
e. None is needed at all because they are not very penetrating.

ANSWER: a

111. Which of the following does NOT need to be considered when determining what sort of protection against ionizing radiation must be used?
a. type of ionizing radiation
b. energy of the radiation
c. duration of contact with the ionizing radiation
d. penetrating power of the ionizing radiation
e. All of the above should be considered.

ANSWER: e

112. Why is it necessary to shield yourself from gamma radiation and beta and alpha particles but not from radio waves or microwaves?
a. Radio waves and microwaves do not have much penetrating power.
b. Radio waves and microwaves are lower in energy, so they are not ionizing.
c. Radio waves and microwaves are higher in energy, so they pass through the body without adverse effect.
d. Radio waves and microwaves are not electromagnetic radiation.
e. Gamma radiation and beta and alpha particles are not ionizing.

ANSWER: b

113. Which of the following describes a benefit of using Sieverts instead of grays to measure the quantity of radiation that a patient has received?
a. Sieverts measure the biological effect of radiation, not just quantity.
b. Grays measure the biological effect of radiation, not just quantity.
c. Sieverts measure the amount of energy absorbed, not just quantity.
d. Grays measure the amount of energy absorbed, not just quantity.
e. There is no benefit.

ANSWER: a

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114. Effective dose measurements take into account the _____ of a type of radiation.

a. energy
b. penetrating ability
c. biological effect
d. quantity
e. All of the above are taken into account for the effective dose measurement.

ANSWER: e

115. Which statement BEST interprets the statement below?

The LD_{50} for radiation is an acute dose of 3–4 Sv.

a. Exposure to 50 mg of a radiation source will result in radiation poisoning.
b. Exposure to 50 mg of a radiation source will result in death.
c. Fifty percent of people exposed to this dose will get sick within one month of the exposure.
d. Fifty percent of people exposed to this dose will die within one month of the exposure.
e. 4 to 6 Sv is the maximum dose that 50% of people can undergo without long-term injury.

ANSWER: d

116. What sort of information do the units used in this table take into account?

Effective Dose (Sv)	Symptoms
0.05–0.2	None
0.2–0.5	Temporary decrease in white blood cell count.
0.5–1.0	Headache and increased risk of infection. Possible temporary male sterility.
1.0–2.0	LD_{10}; nausea, hair loss, fatigue. Loss of white blood cells; temporary male sterility.
2–3	LD_{35}; loss of hair all over the body, fatigue and general illness. High risk of infection.
3–4	LD_{50}; uncontrollable bleeding in the mouth. Permanent sterility in women.
4–6	LD_{60}; death resulting from internal bleeding and infection. Permanent female sterility.
6–10	LD_{100}; death after 14 days.

a. energy of the radiation
b. penetrating ability of the radiation
c. quality factor of the radiation
d. quantity of the radiation
e. All of the above are taken into account.

ANSWER: e

117. What is the minimum dosage in which people are observed to die from radiation sickness?

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Effective Dose (Sv)	Symptoms
0.05–0.2	None
0.2–0.5	Temporary decrease in white blood cell count.
0.5–1.0	Headache and increased risk of infection. Possible temporary male sterility.
1.0–2.0	LD_{10}; nausea, hair loss, fatigue. Loss of white blood cells; temporary male sterility.
2–3	LD_{35}; loss of hair all over the body, fatigue and general illness. High risk of infection.
3–4	LD_{50}; uncontrollable bleeding in the mouth. Permanent sterility in women.
4–6	LD_{60}; death resulting from internal bleeding and infection. Permanent female sterility.
6–10	LD_{100}; death after 14 days.

a. 0.2–0.5 Sv
b. 0.5–1.0 Sv
c. 1.0–2.0 Sv
d. 2–3 Sv
e. 3–4 Sv

ANSWER: c

118. Which of the following choices describes an acute dose of radiation?
a. the dose that an x-ray technician receives over the course of her career
b. the dose that a scientist receives while working with radioactive materials for a multiyear research project
c. the annual dose that a pilot is exposed to
d. the dose that is received by handling a highly radioactive source
e. the annual dose that we all receive as a result of background radiation

ANSWER: d

119. How does computed tomography (CT) differ from standard x-ray imaging?
a. CT scans involve software as well as x-ray imaging.
b. CT scans use an array of detectors.
c. CT scans are 3D; X-rays are 2D.
d. All of the above list how CT scans differ from x-ray imaging.

ANSWER: d

120. The figure below is an example of which imaging technique(s)?

I. x-ray
II. computed tomography

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a. I only
b. II only
c. I and II
d. neither I nor II
e. This figure could be any of these imaging techniques.

ANSWER: a

121. Which of the imaging technique(s) listed below is harmless to the patient?
I. x-ray
II. computed tomography
a. I only
b. II only
c. I and II
d. neither I nor II

ANSWER: d

122. Which of the method(s) of imaging listed below produces three-dimensional images?
I. x-ray
II. computed tomography
a. I only
b. II only
c. I and II
d. neither I nor II

ANSWER: b

123. Which of the method(s) of imaging listed below uses x-rays?
I. x-ray
II. computed tomography
a. I only
b. II only

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c. I and II

d. neither I nor II

ANSWER: c

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