

## First Quarter Review- Multiple Choice

1. Element  $X$  has two isotopes. If 72.0% of the element has an isotopic mass of 84.9 atomic mass units, and 28.0% of the element has an isotopic mass of 87.0 atomic mass units, the average atomic mass of element  $X$  is numerically equal to

- A)  $(72.0 + 84.9) \times (28.0 + 87.0)$   
 B)  $(72.0 - 84.9) \times (28.0 + 87.0)$   
 C)  $\frac{72.0 \times 84.9}{100} + \frac{28.0 \times 87.0}{100}$   
 D)  $(72.0 \times 84.9) + (28.0 \times 87.0)$

2. All the isotopes of a given atom have

- A) the same mass number and the same atomic number  
 B) the same mass number but different atomic numbers  
 C) different mass numbers but the same atomic number  
 D) different mass numbers and different atomic numbers

3. Aqueous solutions of compounds containing element  $X$  are blue. Element  $X$  could be

- A) carbon    B) copper    C) sodium    D) sulfur

4. Atoms of  $^{16}\text{O}$ ,  $^{17}\text{O}$ , and  $^{18}\text{O}$  have the same number of

- A) neutrons, but a different number of protons  
 B) protons, but a different number of neutrons  
 C) protons, but a different number of electrons  
 D) electrons, but a different number of protons

5. A beta particle may be spontaneously emitted from

- A) a ground-state electron    B) a stable nucleus  
 C) an excited electron    D) an unstable nucleus

6. Which of the following Period 3 elements has the *least* metallic character?

- A) Na    B) Mg    C) Al    D) Si

7. Which subatomic particles are located in the nucleus of an He-4 atom?

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

8. Which general trend is found in Period 3 as the elements are considered in order of increasing atomic number?

- A) increasing atomic radius  
 B) increasing electronegativity  
 C) decreasing atomic mass  
 D) decreasing first ionization energy

9. Which reaction is an example of natural transmutation?

- A)  ${}_{94}^{239}\text{Pu} \rightarrow {}_{92}^{235}\text{U} + {}_2^4\text{He}$   
 B)  ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$   
 C)  ${}_{92}^{238}\text{U} + {}_0^1\text{n} \rightarrow {}_{94}^{239}\text{Pu} + 2 {}_{-1}^0\text{e}$   
 D)  ${}_{94}^{239}\text{Pu} + {}_0^1\text{n} \rightarrow {}_{56}^{147}\text{Ba} + {}_{38}^{90}\text{Sr} + 3 {}_0^1\text{n}$

10. What is a problem commonly associated with nuclear power facilities?

- A) A small quantity of energy is produced.  
 B) Reaction products contribute to acid rain.  
 C) It is impossible to control nuclear fission.  
 D) It is difficult to dispose of wastes.

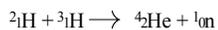
11. Which Lewis electron-dot diagram is correct for a  $\text{S}^{2-}$  ion?

- A)  $\left[ \cdot \ddot{\text{S}} \cdot \right]^{2-}$     B)  $\left[ \ddot{\text{S}} \right]^{2-}$   
 C)  $\left[ \cdot \ddot{\text{S}} \cdot \right]^{2-}$     D)  $\left[ \cdot \ddot{\text{S}} \cdot \right]^{2-}$

12. Which two notations represent different isotopes of the same element?

- A)  ${}^6_4\text{Be}$  and  ${}^9_4\text{Be}$     B)  ${}^7_3\text{Li}$  and  ${}^7_3\text{Li}$     C)  ${}^{14}_7\text{N}$  and  ${}^{14}_6\text{C}$     D)  ${}^{32}_{15}\text{P}$  and  ${}^{32}_{16}\text{S}$

13. Given the balanced equation representing a nuclear reaction:



Which phrase identifies and describes this reaction?

- A) fission, mass converted to energy  
B) fission, energy converted to mass  
C) fusion, mass converted to energy  
D) fusion, energy converted to mass
14. An atom of argon in the ground state tends *not* to bond with an atom of a different element because the argon atom has

- A) more protons than neutrons  
B) more neutrons than protons  
C) a total of two valence electrons  
D) a total of eight valence electrons

15. An atom of any element must contain

- A) an equal number of protons and neutrons  
B) an equal number of protons and electrons  
C) more electrons than neutrons  
D) more electrons than protons

16. As the elements in Group 15 are considered in order of increasing atomic number, which sequence in properties occurs?

- A) nonmetal  $\rightarrow$  metalloid  $\rightarrow$  metal  
B) metalloid  $\rightarrow$  metal  $\rightarrow$  nonmetal  
C) metal  $\rightarrow$  metalloid  $\rightarrow$  nonmetal  
D) metal  $\rightarrow$  nonmetal  $\rightarrow$  metalloid

17. Samples of four Group 15 elements, antimony, arsenic, bismuth, and phosphorus, are in the gaseous phase. An atom in the ground state of which element requires the *least* amount of energy to remove its most loosely held electron?

- A) As    B) Bi    C) P    D) Sb

18. The elements on the Periodic Table are arranged in order of increasing

- A) atomic mass    B) atomic number  
C) molar mass    D) oxidation number

19. What is the total number of neutrons in an atom of  ${}^7_3\text{Li}$ ?

- A) 7    B) 10    C) 3    D) 4

20. Which radioisotope is used to treat thyroid disorders?

- A) Co-60    B) I-131    C) C-14    D) U-238

21. At STP, which element is solid, brittle, and a poor conductor of electricity?

- A) Al    B) K    C) Ne    D) S

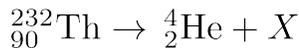
22. The number of neutrons in the nucleus of an atom can be determined by

- A) adding the atomic number to the mass number  
B) subtracting the atomic number from the mass number  
C) adding the mass number to the atomic mass  
D) subtracting the mass number from the atomic number

23. Which equation represents a spontaneous nuclear decay?

- A)  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$   
B)  $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$   
C)  ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{n}$   
D)  ${}^{90}_{38}\text{Sr} \rightarrow {}^0_{-1}\text{e} + {}^{90}_{39}\text{Y}$

24. Given the equation representing a nuclear reaction in which *X* represents a nuclide:



Which nuclide is represented by *X*?

- A)  ${}^{236}_{92}\text{Ra}$   
B)  ${}^{228}_{88}\text{Ra}$   
C)  ${}^{236}_{92}\text{U}$   
D)  ${}^{228}_{88}\text{U}$

25. Which list of nuclear emissions is arranged in order from the *least* penetrating power to the greatest penetrating power?

- A) alpha particle, beta particle, gamma ray  
B) alpha particle, gamma ray, beta particle  
C) gamma ray, beta particle, alpha particle  
D) beta particle, alpha particle, gamma ray

26. Which list of elements consists of metalloids, only?

- A) B, Al, Ga    B) C, N, P  
C) O, S, Se    D) Si, Ge, As

27. Pure silicon is chemically classified as a metalloid because silicon

- A) is malleable and ductile  
B) is an excellent conductor of heat and electricity  
C) exhibits metallic and nonmetallic properties  
D) none of the above

28. Which salt contains an ion that forms a colored solution?

- A)  $\text{Mg}(\text{NO}_3)_2$     B)  $\text{Ca}(\text{NO}_3)_2$   
C)  $\text{Ni}(\text{NO}_3)_2$     D)  $\text{Al}(\text{NO}_3)_3$

29. What are two properties of most nonmetals?

- A) high ionization energy and poor electrical conductivity  
B) high ionization energy and good electrical conductivity  
C) low ionization energy and poor electrical conductivity  
D) low ionization energy and good electrical conductivity

30. Which Lewis electron-dot diagram represents a nitrogen atom in the ground state?

- A)  $\begin{array}{c} \cdot\cdot \\ \text{N} \\ \cdot\cdot \end{array}$     B)  $\begin{array}{c} \cdot \\ \text{N} \\ \cdot \end{array}$   
C)  $\begin{array}{c} \cdot\cdot \\ \cdot\text{N} \\ \cdot\cdot \end{array}$     D)  $\begin{array}{c} \cdot\cdot \\ \cdot\text{N} \\ \cdot\cdot \end{array}$

31. Which of the following Period 4 elements has the most metallic characteristics?

- A) Ca    B) Ge    C) As    D) Br

32. Which general trend is demonstrated by the Group 17 elements as they are considered in order from top to bottom on the Periodic Table?

- A) a decrease in atomic radius  
B) a decrease in electronegativity  
C) an increase in first ionization energy  
D) an increase in nonmetallic behavior

33. What is the charge of the nucleus of an oxygen atom?

- A) 0    B) -2    C) +8    D) +16

34. Which nuclear emission has no charge and no mass?

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

35. Which element is considered malleable?

- A) gold    B) hydrogen    C) sulfur    D) radon

36. As a sulfur atom gains electrons, its radius

- A) decreases                      B) increases  
C) remains the same

37. Which fraction of an original 20.00-gram sample of nitrogen-16 remains unchanged after 36.0 seconds?

- A)  $\frac{1}{5}$             B)  $\frac{1}{8}$             C)  $\frac{1}{16}$             D)  $\frac{1}{32}$

38. What is the total number of valence electrons in a germanium atom in the ground state?

- A) 22            B) 2            C) 32            D) 4

39. Which equation represents positron decay?

- A)  ${}_{37}^{87}\text{Rb} \rightarrow {}_{-1}^0\text{e} + {}_{38}^{87}\text{Sr}$   
B)  ${}_{92}^{277}\text{U} \rightarrow {}_{90}^{223}\text{Th} + {}_2^4\text{He}$   
C)  ${}_{13}^{27}\text{Al} + {}_2^4\text{He} \rightarrow {}_{15}^{30}\text{P} + {}_0^1\text{n}$   
D)  ${}_{6}^{11}\text{C} \rightarrow {}_{+1}^0\text{e} + {}_5^{11}\text{B}$

40. As the elements of Group 17 are considered in order of increasing atomic number, there is an increase in

- A) atomic radius  
B) electronegativity  
C) first ionization energy  
D) number of electrons in the first shell

41. The bright-line spectrum of sodium is produced when energy is

- A) absorbed as electrons move from higher to lower electron shells  
B) absorbed as electrons move from lower to higher electron shells  
C) released as electrons move from higher to lower electron shells  
D) released as electrons move from lower to higher electron shells

42. What is the half-life of a radioisotope if 25.0 grams of an original 200.-gram sample of the isotope remains unchanged after 11.46 days?

- A) 2.87 d    B) 3.82 d    C) 11.46 d    D) 34.38 d

43. How does the size of an aluminum atom change when it becomes an ion with a charge of 3+?

- A) It becomes smaller by losing 3 electrons.  
B) It becomes smaller by gaining 3 electrons.  
C) It becomes larger by losing 3 electrons.  
D) It becomes larger by gaining 3 electrons.

44. Which isotopic ratio needs to be determined when the age of ancient wooden objects is investigated?

- A) uranium-235 to uranium-238  
B) hydrogen-2 to hydrogen-3  
C) nitrogen-16 to nitrogen-14  
D) carbon-14 to carbon-12

45. More than two-thirds of the elements of the Periodic Table are classified as

- A) metalloids                      B) metals  
C) nonmetals                      D) noble gases

46. An ion that consists of 7 protons, 6 neutrons, and 10 electrons has a net charge of

- A) 4-            B) 3-            C) 3+            D) 4+

47. Which principal energy level can hold a maximum of 18 electrons?

- A) 5            B) 2            C) 3            D) 4

48. Which conclusion was a direct result of the gold foil experiment?

- A) An atom is mostly empty space with a dense, positively charged nucleus.  
B) An atom is composed of at least three types of subatomic particles.  
C) An electron has a positive charge and is located inside the nucleus.  
D) An electron has properties of both waves and particles.

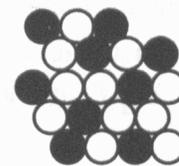
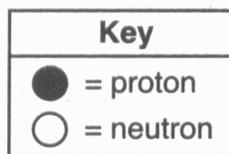
49. Which nuclear emission has the greatest penetrating power?

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

50. Compared to the mass and the penetrating power of an alpha particle, a beta particle has

- A) less mass and greater penetrating power  
B) less mass and less penetrating power  
C) more mass and greater penetrating power  
D) more mass and less penetrating power

51. The diagram below represents the nucleus of an atom.



What are the atomic number and mass number of this atom?

- A) The atomic number is 9 and the mass number is 19.  
B) The atomic number is 9 and the mass number is 20.  
C) The atomic number is 11 and the mass number is 19.  
D) The atomic number is 11 and the mass number is 20.

52. Which two characteristics are associated with metals?

- A) low first ionization energy and low electronegativity  
B) low first ionization energy and high electronegativity  
C) high first ionization energy and low electronegativity  
D) high first ionization energy and high electronegativity

53. Which electron configuration represents the electrons of an atom in an excited state?

- A) 2-1            B) 2-7-4            C) 2-8-7            D) 2-4

54. Which statement best describes what happens in a fission reaction?

- A) Heavy nuclei split into lighter nuclei.  
B) Light nuclei form into heavier nuclei.  
C) Energy is released and less stable elements are formed.  
D) Energy is absorbed and more stable elements are formed.

55. In which section of the Periodic Table are the most active metals located?

- A) upper right corner                      B) lower right corner  
C) upper left corner                      D) lower left corner

56. Which two particles each have a mass approximately equal to one atomic mass unit?

- A) electron and neutron                      B) electron and positron  
C) proton and electron                      D) proton and neutron

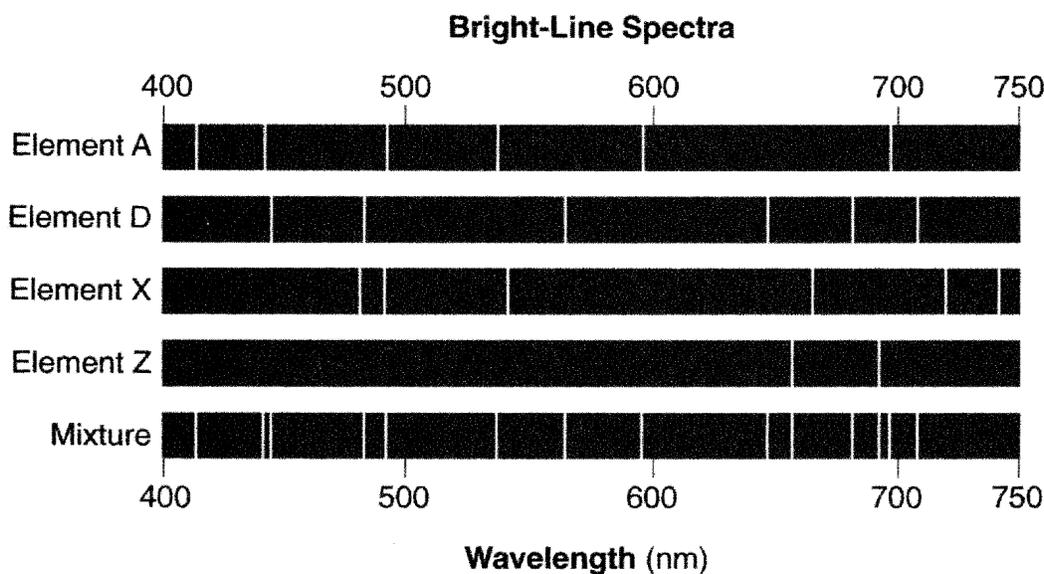
57. Which statement describes how an atom in the ground state becomes excited?

- A) The atom absorbs energy, and one or more electrons move to a higher electron shell.  
B) The atom absorbs energy, and one or more electrons move to a lower electron shell.  
C) The atom releases energy, and one or more electrons move to a higher electron shell.  
D) The atom releases energy, and one or more electrons move to a lower electron shell.

58. In which reaction is mass converted to energy by the process of fission?

- A)  ${}_{7}^{14}\text{N} + {}_0^1\text{n} \rightarrow {}_6^{14}\text{C} + {}_1^1\text{H}$   
B)  ${}_{92}^{235}\text{U} + {}_0^1\text{n} \rightarrow {}_{35}^{87}\text{Br} + {}_{57}^{146}\text{La} + 3{}_0^1\text{n}$   
C)  ${}_{88}^{226}\text{Ra} \rightarrow {}_{86}^{222}\text{Ra} + {}_2^4\text{He}$   
D)  ${}_1^2\text{H} + {}_1^2\text{H} \rightarrow {}_2^4\text{He}$

59. The diagram below represents the bright-line spectra of four elements and a bright-line spectrum produced by a mixture of three of these elements.



Which element is *not* present in the mixture?

- A) *A*                      B) *D*                      C) *X*                      D) *Z*

60. The stability of an isotope is based on its

- A) number of neutrons, only      B) number of protons, only  
C) ratio of neutrons to protons      D) ratio of electrons to protons

61. In which type of reaction is an atom of one element converted to an atom of a different element?

- A) decomposition                      B) neutralization  
C) saponification                      D) transmutation

62. Which statement describes the relative energy of the electrons in the shells of a calcium atom?

- A) An electron in the first shell has more energy than an electron in the second shell.  
B) An electron in the first shell has the same amount of energy as an electron in the second shell.  
C) An electron in the third shell has more energy than an electron in the second shell.  
D) An electron in the third shell has less energy than an electron in the second shell.

63. Which subatomic particles are located in the nucleus of a carbon atom?

- A) protons, only                      B) neutrons, only  
C) protons and neutrons              D) protons and electron

64. An atom in the ground state contains a total of 5 electrons, 5 protons, and 5 neutrons. Which Lewis electron-dot diagram represents this atom?

- A)      B)      C)      D)

65. Atoms of metallic elements tend to

- A) gain electrons and form negative ions  
B) gain electrons and form positive ions  
C) lose electrons and form negative ions  
D) lose electrons and form positive ions

66. Which set of properties is most characteristic of transition elements?

- A) colorless ions in solution, multiple positive oxidation states  
B) colorless ions in solution, multiple negative oxidation states  
C) colored ions in solution, multiple positive oxidation states  
D) colored ions in solution, multiple negative oxidation states

67. What is the mass number of an atom that contains 19 protons, 19 electrons, and 20 neutrons?

- A) 19                      B) 20                      C) 39                      D) 58

68. An element occurs as a mixture of isotopes. The atomic mass of the element is based upon

- A) the masses of the individual isotopes, only  
B) the relative abundances of the isotopes, only  
C) both the masses and the relative abundances of the individual isotopes  
D) neither the masses nor the relative abundances of the individual isotopes

69. A radioactive-dating procedure to determine the age of a mineral compares the mineral's remaining amounts of isotope  $^{238}\text{U}$  and isotope

- A)  $^{206}\text{Pb}$       B)  $^{206}\text{Bi}$       C)  $^{214}\text{Pb}$       D)  $^{214}\text{Bi}$

70. Which element is an alkali metal?

- A) Na                      B) Mg                      C) Al                      D) Cl