Chapter 2: Atoms, Ions, and Molecules: Matter Starts Here

MULTIPLE CHOICE

1. Who discovered electrons?
   a. Robert Boyle
   b. Robert Millikan
   c. Joseph John Thomson
   d. John Dalton
   e. Albert Einstein

   ANS: C DIF: Easy REF: 2.2
   OBJ: Explain how the experiments of Thomson, Millikan, and Rutherford contributed to our understanding of atomic structure. MSC: Remembering

2. Who was the first scientist to determine the charge of an electron?
   a. Robert Boyle
   b. Robert Millikan
   c. Joseph John Thomson
   d. John Dalton
   e. Albert Einstein

   ANS: B DIF: Easy REF: 2.2
   OBJ: Explain how the experiments of Thomson, Millikan, and Rutherford contributed to our understanding of atomic structure. MSC: Remembering

3. In the atoms in the Rutherford–Geiger–Marsden experiment, the alpha particles were repelled by _____
   a. electrons.
   b. protons.
   c. neutrons.
   d. nuclei.
   e. gravity.

   ANS: D DIF: Easy REF: 2.2
   OBJ: Describe the evidence obtained from the Rutherford–Geiger–Marsden experiment with alpha particles and how it rejected the plum-pudding model and led to the nuclear model of atomic structure.
   MSC: Remembering

4. The Rutherford–Geiger–Marsden gold foil experiments paved the way for the nuclear model of the atom, replacing _____ of the atom.
   a. the quantum mechanical model
   b. Dalton's theory
   c. Avogadro's law
   d. the plum-pudding model
   e. Einstein's relativistic theory

   ANS: D DIF: Easy REF: 2.2
   OBJ: Describe the evidence obtained from the Rutherford–Geiger–Marsden experiment with alpha particles and how it rejected the plum-pudding model and led to the nuclear model of atomic structure.
   MSC: Remembering

5. Which one of the following experiments provided evidence that atoms contained small massive nuclei with positive charges?
   a. Bunsen and Kirchoff's flame test
   b. Fraunhofer lines
   c. the Rutherford–Geiger–Marsden experiment
   d. Thomson's experiments with cathode ray tubes
   e. Millikan's oil-drop experiment

ANS: C DIF: Easy REF: 2.2
OBJ: Describe the evidence obtained from the Rutherford–Geiger–Marsden experiment with alpha particles and how it rejected the plum-pudding model and led to the nuclear model of atomic structure.
MSC: Remembering

6. What is the correct symbol for an electron?
   a. $^{0}_{-1}e$
   b. $^{1}_{1}e$
   c. $^{0}_{1}e$
   d. $^{1}_{-1}e$
   e. $^{0}_{0}e$

   ANS: A DIF: Easy REF: 2.2
   OBJ: Identify and describe the particles that comprise an atom and their symbols.
   MSC: Remembering

7. What is the correct symbol for a proton?
   a. $^{0}_{-1}\mathrm{p}$
   b. $^{0}_{1}\mathrm{p}$
   c. $^{1}_{1}\mathrm{p}$
   d. $^{1}_{0}\mathrm{p}$
   e. $^{0}_{0}\mathrm{p}$

   ANS: C DIF: Easy REF: 2.2
   OBJ: Identify and describe the particles that comprise an atom and their symbols.
   MSC: Remembering

8. What is the correct symbol for a neutron?
   a. $^{1}_{0}\mathrm{n}$
   b. $^{1}_{1}\mathrm{n}$
   c. $^{0}_{1}\mathrm{n}$
   d. $^{1}_{-1}\mathrm{n}$
   e. $^{0}_{0}\mathrm{n}$

   ANS: A DIF: Easy REF: 2.2
   OBJ: Identify and describe the particles that comprise an atom and their symbols.
   MSC: Remembering

9. Protons and neutrons are examples of _____
   a. nuclei.
   b. nuclides.
   c. nucleons.
   d. isotopes.
   e. charged particles.

   ANS: C DIF: Easy REF: 2.2
   OBJ: Identify and describe the particles that comprise an atom and their symbols.
   MSC: Remembering

10. The ^{4}He nucleus is an example of _____
    a. a nuclide.
    b. a muon.
    d. a neutron.
    e. a nucleon.

c. a proton.

ANS: A DIF: Easy REF: 2.2
OBJ: Identify and describe the particles that comprise an atom and their symbols.
MSC: Remembering

11. Which statement is correct?
    a. Electrons, protons, and neutrons have about the same mass.
    b. Electrons have a much smaller mass than that of protons and neutrons.
    c. Neutrons are much more massive than protons.
    d. Protons are much more massive than neutrons.
    e. Electrons have a much larger mass than that of protons and neutrons.

    ANS: B DIF: Easy REF: 2.2
    OBJ: Compare the relative masses of electrons, protons, and neutrons.
    MSC: Remembering

12. Which statement is *not* correct? In atomic mass units (amu or u), _____
    a. the mass of an electron, proton, or neutron is approximately 1 u.
    b. the mass of a proton or neutron is approximately 1 u, and the mass of an electron is approximately 0 u.
    c. the mass of an atom is approximately equal to the number of protons and neutrons in the nucleus of the atom.
    d. the mass of a carbon-12 atom is exactly 12 u.
    e. the mass of an oxygen-16 atom is approximately 16 u.

    ANS: A DIF: Easy REF: 2.2
    OBJ: Compare the relative masses of electrons, protons, and neutrons.
    MSC: Remembering

13. Which statement is *not* correct?
    a. Electrons have a negative electrical charge.
    b. Protons have a positive electrical charge.
    c. Neutrons do not have an electrical charge.
    d. In an atom, the interaction between electrons and protons is attractive.
    e. In an atom, the interaction between electrons and neutrons is repulsive.

    ANS: E DIF: Easy REF: 2.2
    OBJ: Compare the electrical charges of electrons, protons, and neutrons.
    MSC: Remembering

14. Which statement about isotopes of the same element is *not* correct?
    a. They have the same number of protons.
    b. They have different numbers of neutrons.
    c. They have essentially the same chemical properties.
    d. They have the same atomic mass.
    e. They have the same number of electrons.

    ANS: D DIF: Easy REF: 2.3
    OBJ: Write a definition of the term isotope, and identify the feature that distinguishes one isotope from another. MSC: Remembering

15. Which statement best describes isotopes?
    a. They have the same atomic mass.
    b. They have the same total number of protons and neutrons.

c. They have the same number of neutrons but a different number of protons.
d. They have the same number of protons but a different number of neutrons.
e. They have very different chemical reactivity.

ANS: D DIF: Easy REF: 2.3
OBJ: Write a definition of the term isotope, and identify the feature that distinguishes one isotope from another. MSC: Remembering

16. ^{1}H, ^{2}H, and ^{3}H are examples of _____ because they have different numbers of _____.
a. isotopes; protons
b. isotopes; neutrons
c. isotopes; electrons
d. allotropes; neutrons
e. allotropes; protons

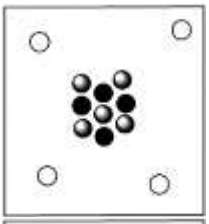
ANS: B DIF: Easy REF: 2.3
OBJ: Write a definition of the term isotope, and identify the feature that distinguishes one isotope from another. MSC: Remembering

17. Which of the following atoms contains the least number of neutrons?
a. ^{30}Si
b. ^{27}Al
c. ^{35}Cl
d. ^{32}S
e. ^{39}K

ANS: B DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

18. Which particle-level diagram is the best representation of a $^{9}_{4}Be^{2+}$ ion?

● = Proton
◒ = Neutron
○ = Electron

a.


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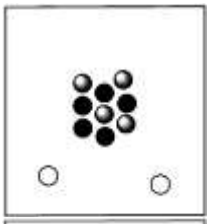

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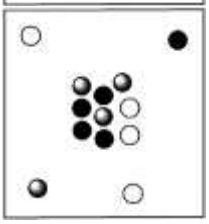

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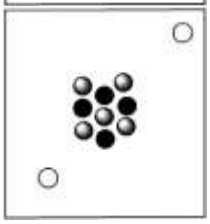
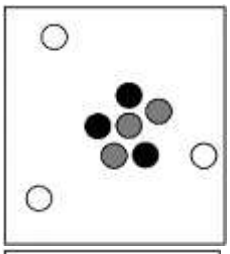
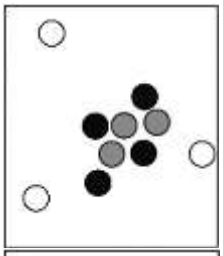


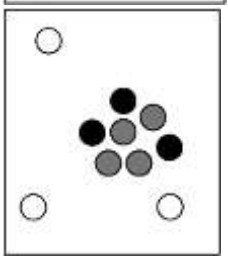
ANS: D DIF: Easy REF: 2.3
OBJ: Describe how particles are distributed in an atom given its atomic symbol.
MSC: Understanding

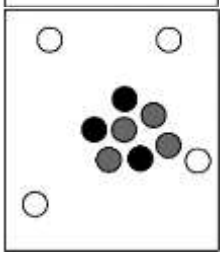
19. Which particle-level diagram is the best representation for a $^{7}_{3}Li$ atom?

● = Proton
◒ = Neutron
○ = Electron

a. 

c. 

b. 

d. 

ANS: B DIF: Easy REF: 2.3
OBJ: Describe how particles are distributed in an atom given its atomic symbol.
MSC: Understanding

20. A $^{55}_{25}Mn^{2+}$ ion has _____ protons, _____ neutrons, and _____electrons.
a. 23; 30; 25
b. 25; 30; 23
c. 30; 25; 23
d. 25; 30; 25
e. 30; 25; 30

ANS: B DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

21. A $^{35}_{17}Cl$ atom has _____ protons, _____ neutrons, and _____ electrons.
a. 17; 18; 19
b. 17; 20; 17
c. 17; 17; 20
d. 17; 18; 17
e. 18; 17; 18

ANS: D DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

22. A $^{16}_{8}O^{2-}$ ion has _____ protons, _____ neutrons, and _____ electrons.
a. 8; 8; 6
b. 8; 10; 10
c. 8; 8; 10
d. 8; 8; 8
e. 8; 16; 8

ANS: C DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

23. What is the symbol of the ion having 12 protons and 10 electrons?
a. Mg^{2+}
b. Al^{3+}
c. Mg^{2-}
d. Na^{2+}
e. Mg

ANS: A DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and

electrons comprising an ion. MSC: Applying

24. What is the symbol of the ion having 17 protons and 18 electrons?
    a. S^{2-}
    b. Cl
    c. Cl^{-}
    d. Cl^{+}
    e. K^{+}

    ANS: C DIF: Easy REF: 2.3
    OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

25. A hypothetical element has two stable isotopes: one isotope has a mass of 106.9051 amu with an abundance of 48.183%, the other isotope has a mass of 108.9048 amu with an abundance of 51.825%. What is the average atomic mass of this element?
    a. 107.980 amu
    b. 107.970 amu
    c. 107.960 amu
    d. 107.950 amu
    e. 107.940 amu

    ANS: D DIF: Easy REF: 2.4
    OBJ: Use natural abundance data for isotopes to calculate an average atomic mass.
    MSC: Applying

26. An unknown element is found to contain isotopes with the following masses and natural abundances: 38.9637 amu (93.08%), 39.9640 amu (0.012%), and 40.9618 amu (6.91%). Using these data, identify the element.
    a. S
    b. Cl
    c. Ar
    d. K
    e. Ca

    ANS: D DIF: Difficult REF: 2.4
    OBJ: Use natural abundance data for isotopes to calculate an average atomic mass.
    MSC: Applying

27. Enriched weapons-grade uranium consists of 80% uranium-235 (235.044 amu) and 20% uranium-238 (238.051 amu). What is the average atomic mass of weapons-grade uranium, assuming the percentages are exact?
    a. 235.044 amu
    b. 236.547 amu
    c. 238.051 amu
    d. 235.645 amu
    e. 235.754 amu

    ANS: D DIF: Medium REF: 2.4
    OBJ: Use natural abundance data for isotopes to calculate an average atomic mass.
    MSC: Applying

28. The Curiosity rover now on Mars analyzed rocks and found magnesium to have the following isotopic composition. What is the average atomic mass of magnesium in these rocks?

Mass (u)	% Abundance
23.9872	79.70
24.9886	10.13
25.9846	10.17

    a. 24.31 u
    b. 24.29 u
    c. 24.33 u
    d. 24.99 u
    e. 33.33 u

ANS: B DIF: Easy REF: 2.4
OBJ: Use natural abundance data for isotopes to calculate an average atomic mass.
MSC: Applying

29. There are three major isotopes of silicon: silicon-28, silicon-29, and silicon-30. Given the average atomic mass of silicon is 28.10 amu, estimate the percent abundance of the most abundant isotope of silicon.
a. 8%
b. 20%
c. 66%
d. 80%
e. 92%

ANS: E DIF: Medium REF: 2.4
OBJ: Identify the isotope that is likely to be the most abundant, given the masses of the isotopes and the average atomic mass. MSC: Understanding

30. For each of the elements below, there are only two naturally occurring isotopes. Using information in your periodic table, identify the pair in which the heavier isotope is the more abundant one.
a. ^{63}Cu and ^{65}Cu
b. ^{85}Rb and ^{87}Rb
c. ^{10}B and ^{11}B
d. ^{79}Br and ^{81}Br
e. ^{14}N and ^{15}N

ANS: C DIF: Medium REF: 2.4
OBJ: Identify the isotope that is likely to be the most abundant, given the masses of the isotopes and the average atomic mass. MSC: Understanding

31. For each of the elements below, there are only two naturally occurring isotopes. Using information in your periodic table, identify the pair in which the lighter isotope is the more abundant one.
a. ^{6}Li and ^{7}Li
b. ^{79}Br and ^{81}Br
c. ^{10}B and ^{11}B
d. ^{191}Ir and ^{193}Ir
e. ^{50}V and ^{51}V

ANS: B DIF: Medium REF: 2.4
OBJ: Identify the isotope that is likely to be the most abundant, given the masses of the isotopes and the average atomic mass. MSC: Understanding

32. Zinc has five naturally occurring isotopes with an average mass of 65.39 amu. Three isotopes, in roughly equal amounts, account for 95% of zinc. Which isotope is most abundant?
a. ^{64}Zn, 63.9291 amu
b. ^{66}Zn, 65.9260 amu
c. ^{67}Zn, 66.9271 amu
d. ^{68}Zn, 67.9249 amu
e. ^{70}Zn, 69.9253 amu

ANS: A DIF: Difficult REF: 2.4
OBJ: Identify the isotope that is likely to be the most abundant, given the masses of the isotopes and the average atomic mass. MSC: Understanding

33. The average atomic mass of zinc is 65.39 amu. Given the data in the following table, what is the natural abundance of ^{66}Zn?

Isotope	*Mass (amu)*	*Natural Abundance (%)*
^{64}***Zn***	***63.9291***	***48.89***
^{66}***Zn***	***65.9260***	***?***
^{67}***Zn***	***66.9271***	***4.11***
^{68}***Zn***	***67.9249***	***18.56***
^{70}***Zn***	***69.9253***	***0.62***

a. 27.83%
b. 0.2783%
c. 50.00%
d. 2.783%
e. 28.73%

ANS: A DIF: Easy REF: 2.4
OBJ: Determine the abundance of an isotope given the average atomic mass, isotope masses, and abundances of the other isotopes. MSC: Applying

34. The mass of thallium (Tl) on the periodic table is given as 204.3833 without any units. There are 47 isotopes of thallium, but only two are stable and abundant, thallium-203, with a mass of 202.9723 amu, and thallium-205, with a mass of 204.9744 amu. What is the percentage of each of these isotopes in naturally occurring thallium?
a. 29.5% ^{203}Tl and 70.5% ^{205}Tl
b. 70.5% ^{203}Tl and 29.5% ^{205}Tl
c. 25.5% ^{203}Tl and 74.5% ^{205}Tl
d. 74.5% ^{203}Tl and 25.5% ^{205}Tl
e. 32.5% ^{203}Tl and 67.5% ^{205}Tl

ANS: A DIF: Medium REF: 2.4
OBJ: Determine the abundance of an isotope given the average atomic mass, isotope masses, and abundances of the other isotopes. MSC: Applying

35. Which statement regarding the organization of the periodic table is *not* correct?
a. Mendeleev arranged known elements with similar chemical properties in columns.
b. Mendeleev's predictions of the chemical properties of unknown elements facilitated their discovery.
c. Mendeleev arranged the elements in order of increasing atomic mass.
d. The modern periodic table arranges elements in order of increasing atomic number.
e. The elements go from gases to liquids to solids in order down the columns in Mendeleev's periodic table.

ANS: E DIF: Easy REF: 2.5
OBJ: Describe how Mendeleev's early periodic table differs from the modern periodic table.
MSC: Remembering

36. What is the symbol for silicon?
a. S
b. Sn
c. Sr
d. Se
e. Si

ANS: E DIF: Easy REF: 2.5
OBJ: Convert between the name and symbol of an element. MSC: Remembering

37. What is the symbol for magnesium?
a. M
b. Mg
c. Mn
d. Mo
e. Ma

ANS: B DIF: Easy REF: 2.5
OBJ: Convert between the name and symbol of an element. MSC: Remembering

38. He is the symbol for _____
a. hydrogen.
b. hafnium.
c. mercury.
d. helium.
e. holmium.

ANS: D DIF: Easy REF: 2.5
OBJ: Convert between the name and symbol of an element. MSC: Remembering

39. Ca is the symbol for _____
    a. cesium.
    b. cobalt.
    c. cadmium.
    d. calcium.
    e. cerium.

    ANS: D DIF: Easy REF: 2.5
    OBJ: Convert between the name and symbol of an element. MSC: Remembering

40. The sixth period of the periodic table contains _____ elements.
    a. 18
    b. 32
    c. 24
    d. 16
    e. 8

    ANS: B DIF: Medium REF: 2.5
    OBJ: Write definitions of the terms period and group as used with the periodic table.
    MSC: Applying

41. Which of the following is an alkaline earth metal?
    a. K
    b. Mg
    c. Al
    d. Cu
    e. Na

    ANS: B DIF: Easy REF: 2.5
    OBJ: Associate elements with the group to which they belong. MSC: Remembering

42. Elements 21–30 are known as _____
    a. alkaline earths.
    b. chalcogens.
    c. halides.
    d. transition metals.
    e. rare earths.

    ANS: D DIF: Easy REF: 2.5
    OBJ: Associate elements with the group to which they belong. MSC: Remembering

43. Cesium is an example of _____
    a. an alkali metal.
    b. a transition metal.
    c. an alkaline earth metal.
    d. a halogen.
    e. a chalcogen.

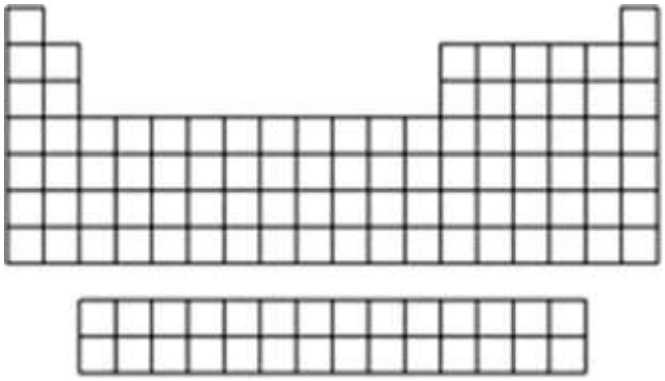
    ANS: A DIF: Easy REF: 2.5
    OBJ: Associate elements with the group to which they belong. MSC: Remembering

44. Elements in group 16 (VIA) are called _____
    a. alkali metals.
    b. pnictogens.
    c. alkaline earth metals.
    d. halogens.
    e. chalcogens.

    ANS: E DIF: Easy REF: 2.5
    OBJ: Associate elements with the group to which they belong. MSC: Remembering

45. Which letter below represents the halogen group?

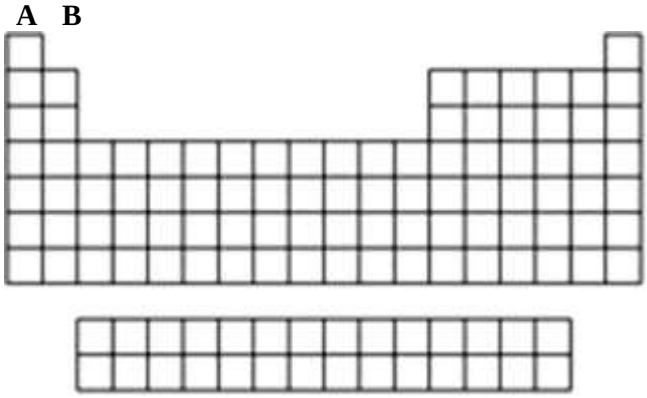
    A B C D E



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

ANS: D DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

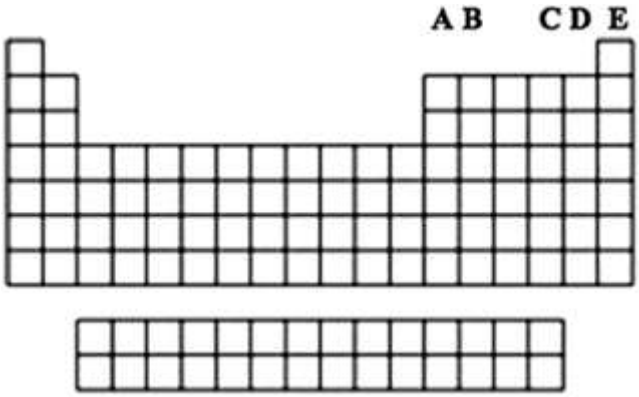
46. Which letter below represents the chalcogen group?



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

ANS: C DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

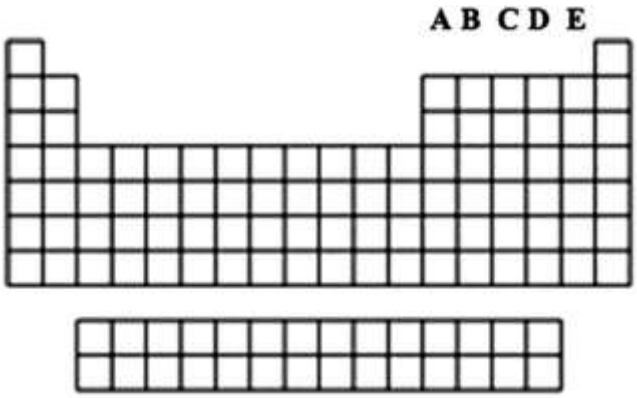
47. Identify the letter of the group that contains the most metalloids.



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

ANS: B DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

48. Identify the letter of the group that contains the most nonmetals.



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

ANS: E DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

49. Elements in group 17 (VIIA) are called _____
a. alkali metals.
b. pnictogens.
c. alkaline earth metals.
d. halogens.
e. chalcogens.

ANS: D DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

50. Which statement below is *not* correct?
a. Oxygen is a chalcogen.
b. Calcium is an alkaline earth metal.
c. Silicon is a nonmetal.
d. Sodium is an alkali metal.
e. Bromine is a halogen.

ANS: C DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

51. The elements below are used in fireworks. Which one is *not* classified correctly according to its position in the periodic table?
a. Sodium is an alkali metal.
b. Strontium is an alkaline earth metal.
c. Iron is a transition metal.
d. Phosphorus is a nonmetal.
e. Sulfur is a metalloid.

ANS: E DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

52. Silicon is best described as a _____

a. metalloid.
b. metal.
c. transition metal.
d. noble gas.
e. nonmetal.

ANS: A DIF: Easy REF: 2.5
OBJ: Identify elements as metals, metalloids, and nonmetals, and describe the general differences among these three categories. MSC: Remembering

53. Potassium is best described as a _____
a. metalloid.
b. metal.
c. transition metal.
d. noble gas.
e. nonmetal.

ANS: B DIF: Easy REF: 2.5
OBJ: Identify elements as metals, metalloids, and nonmetals, and describe the general differences among these three categories. MSC: Remembering

54. Oxygen is best described as a _____
a. metalloid.
b. metal.
c. transition metal.
d. noble gas.
e. nonmetal.

ANS: E DIF: Easy REF: 2.5
OBJ: Identify elements as metals, metalloids, and nonmetals, and describe the general differences among these three categories. MSC: Remembering

55. Iron is best described as a(n) _____
a. metalloid.
b. transition metal.
c. chalcogen.
d. alkaline earth metal.
e. nonmetal.

ANS: B DIF: Easy REF: 2.5
OBJ: Identify the transition metal elements. MSC: Remembering

56. Identify the statement regarding H_2, He, and NH_3 that is correct.
a. H_2 and He are chemical elements.
b. Only He is a chemical element.
c. Only H_2 is a chemical compound.
d. All are chemical elements.
e. All are chemical compounds.

ANS: A DIF: Easy REF: 2.6
OBJ: Distinguish between a chemical element and a chemical compound.
MSC: Understanding

57. Which one of the following statements is *not* consistent with Dalton's atomic view of matter?
a. Atoms of one element can be converted into atoms of another element.
b. Each element is composed of atoms that are identical in size, mass, and chemical properties.
c. Compounds are formed from different atoms in simple whole number ratios.
d. Atoms of different elements can combine in several different proportions to make different compounds.
e. Matter is discrete, as proposed by Democritus.

ANS: A DIF: Easy REF: 2.6
OBJ: State Dalton's law of multiple proportions, explain its significance, and use it to determine combining ratios of elements in forming compounds. MSC: Understanding

58. Dalton's law of multiple proportions deals with _____
    a. the proportions of reacting chemicals that maximize the reaction rate.
    b. the total number of different compounds that can be made from two elements.
    c. the volumes of two elements that can combine to form two or more compounds.
    d. the relative masses of two elements that can combine to form two or more compounds.
    e. reactions that involve multiple steps.

    ANS: D DIF: Medium REF: 2.6
    OBJ: State Dalton's law of multiple proportions, explain its significance, and use it to determine combining ratios of elements in forming compounds. MSC: Understanding

59. Nitrogen and oxygen combine to form several different nitrogen oxides. In one case, 8.4 g of nitrogen reacted completely with 4.8 g of oxygen. In another case, 4.2 g of nitrogen reacted with 9.6 g of oxygen. Which pair of nitrogen oxides is consistent with these data?
    a. NO and N_2O
    b. NO and NO_2
    c. N_2O and N_2O_5
    d. NO and N_2O_4
    e. N_2O and N_2O_4

    ANS: E DIF: Difficult REF: 2.6
    OBJ: State Dalton's law of multiple proportions, explain its significance, and use it to determine combining ratios of elements in forming compounds. MSC: Applying

60. When 10.0 g of sulfur is combined with 10.0 g of oxygen, 20.0 g of sulfur dioxide is formed. What mass of oxygen would be required to convert 10.0 g of sulfur into sulfur trioxide?
    a. 5.0 g
    b. 10 g
    c. 15 g
    d. 30 g
    e. 20 g

    ANS: C DIF: Difficult REF: 2.6
    OBJ: State Dalton's law of multiple proportions, explain its significance, and use it to determine combining ratios of elements in forming compounds. MSC: Applying

61. How many atoms of each element are there in the compound $Na_3(PO_4)_3$?
    a. sodium 3, phosphorus 3, oxygen 12
    b. sodium 9, phosphorus 3, oxygen 12
    c. sodium 3, phosphorus 1, oxygen 4
    d. sodium 3, potassium 1, oxygen 4
    e. sodium 9, potassium 3, oxygen 12

    ANS: A DIF: Easy REF: 2.6
    OBJ: Interpret a molecular formula (a.k.a. chemical formula) or drawing in terms of the number of atoms of each element in a molecule of the compound. MSC: Applying

62. Which one of the following is an anion?
    a. Na^+
    b. CO_2
    c. Cl^-
    d. Na
    e. O_3

    ANS: C DIF: Easy REF: 2.6
    OBJ: Distinguish between anions and cations. MSC: Remembering

63. Which one of the following is a cation?
    a. NO_3^-
    b. SO_2
    c. Ca^{2+}
    d. Na
    e. O_2

ANS: C DIF: Easy REF: 2.6
OBJ: Distinguish between anions and cations. MSC: Remembering

64. What is the empirical formula for dioxane, $C_4H_8O_2$?
a. CHO
b. $C_4H_8O_2$
c. C_2H_4O
d. CH_2O
e. CHO_2

ANS: C DIF: Easy REF: 2.6
OBJ: Distinguish among molecular formulas, empirical formulas, and formula units.
MSC: Applying

65. Locate each element in the periodic table and identify which statement is *not* correct. The common ion of _____ has _____ electrons and a charge of _____.
a. Na; 10; +1
b. K; 18; +1
c. Mg; 10; +2
d. O; 10; –2
e. F; 10; –2

ANS: E DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Applying

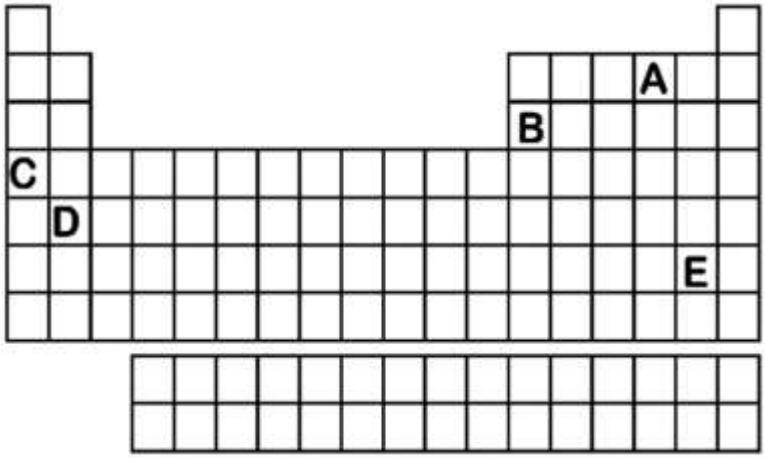
66. Locate each element in the periodic table and identify which statement is *not* correct. The common ion of _____ has _____ electrons and a charge of _____.
a. Cs; 55; +1
b. Ca; 18; +2
c. Ba; 54; +2
d. S; 18; –2
e. Cl; 18; –1

ANS: A DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Applying

67. Based on the element's position in the periodic table, which statement below is *not* correct?
a. The charge on an ion of sodium is 1+.
b. The charge on an ion of magnesium is 2+.
c. The charge on an ion of oxygen is 2–.
d. The charge on an ion of chlorine is 1–.
e. Ca^{2+} has more electrons than Ar.

ANS: E DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Applying

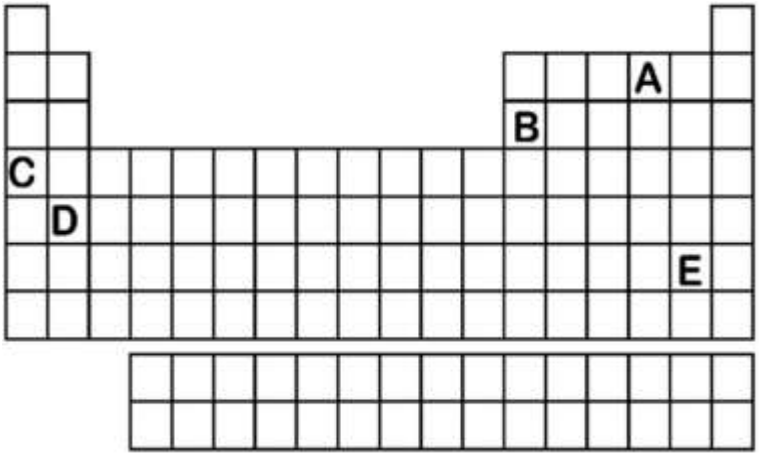
68. Which element labeled A–E in the periodic table below will have an ionic charge of +2?



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

ANS: D DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Understanding

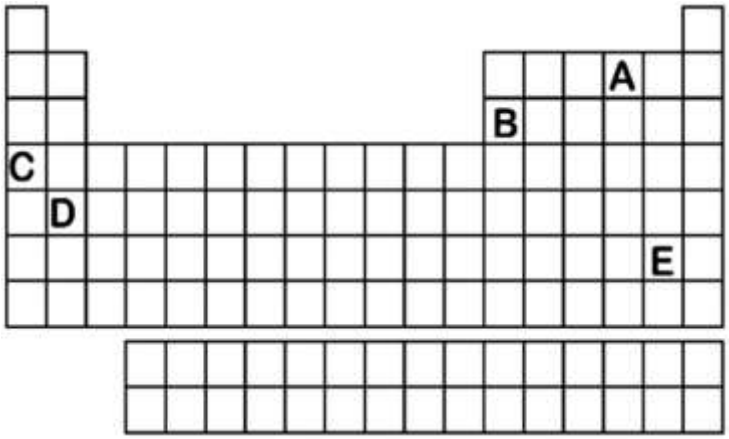
69. Which element labeled A–E in the periodic table below will have an ionic charge of +3?



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

ANS: B DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Understanding

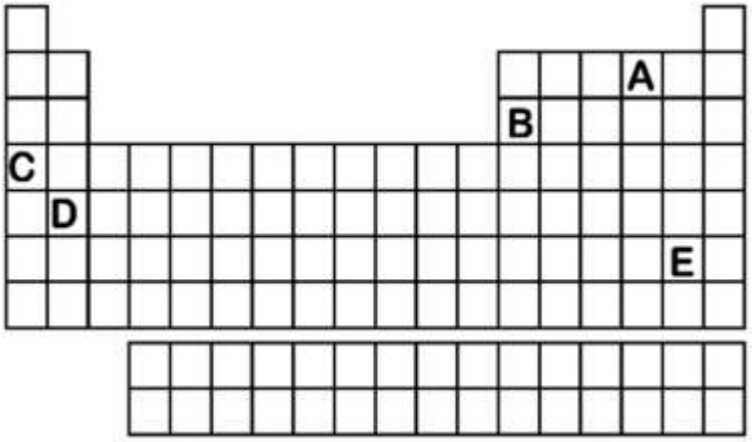
70. Which element labeled A–E in the periodic table below will have an ionic charge of –2?



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

ANS: A DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Understanding

71. Which element labeled A–E in the periodic table below will have an ionic charge of –1?



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

ANS: E DIF: Easy REF: 2.6
OBJ: Relate the number of electrons and charge for an atom or atomic ion to the atom's position in the periodic table. MSC: Understanding

72. Based on its position in the periodic table, which atom would you predict to form an ionic compound with two bromine atoms?
a. sodium
b. aluminum
c. lithium
d. calcium
e. carbon

ANS: D DIF: Easy REF: 2.6
OBJ: Identify combining ratios of atoms based on their positions in the periodic table.
MSC: Applying

73. Based on its position in the periodic table, which atom would you predict to form a compound with one chlorine atom?
    a. boron
    b. aluminum
    c. lithium
    d. calcium
    e. carbon

    ANS: C DIF: Easy REF: 2.6
    OBJ: Identify combining ratios of atoms based on their positions in the periodic table.
    MSC: Applying

74. Based on its position in the periodic table, which atom would you predict to form a compound with three lithium atoms?
    a. boron
    b. carbon
    c. nitrogen
    d. sulfur
    e. fluorine

    ANS: C DIF: Easy REF: 2.6
    OBJ: Identify combining ratios of atoms based on their positions in the periodic table.
    MSC: Applying

75. What is the correct formula for the compound formed between sodium and iodine based on their positions in the periodic table?
    a. Na_2I
    b. NaI_2
    c. NaI
    d. Na_2I_2
    e. Na_3I

    ANS: C DIF: Easy REF: 2.6
    OBJ: Identify combining ratios of atoms based on their positions in the periodic table.
    MSC: Applying

76. What is the correct formula for the compound formed between potassium and phosphorus based on their positions in the periodic table?
    a. K_2P
    b. KP_2
    c. KP
    d. K_2P_2
    e. K_3P

    ANS: E DIF: Easy REF: 2.6
    OBJ: Identify combining ratios of atoms based on their positions in the periodic table.
    MSC: Applying

77. Which one of the following is an ionic compound?
    a. SO_2
    b. ClO_2
    c. H_2O
    d. TiO_2
    e. CO_2

    ANS: D DIF: Easy REF: 2.6
    OBJ: Characterize and classify a compound as molecular or ionic.
    MSC: Understanding

78. Which one of the following is a molecular compound? Molecular compounds also are known as covalent compounds.
    a. Na_2O
    b. CaO
    c. FeO
    d. CCl_4
    e. Fe_2O_3

ANS: D DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Understanding

79. Which of the following is most likely to exhibit covalent bonding?
a. NaF
b. $CaCl_2$
c. Cs_2O
d. CO_2
e. NaCl

ANS: D DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Understanding

80. Identify the binary compound that has ionic bonding.
a. H_2O
b. NO
c. LiF
d. CH_4
e. CF_4

ANS: C DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Understanding

81. Which of the following molecular compounds has an *incorrect* formula or is *not* named correctly?
a. CCl_4, carbon tetrachloride
b. P_2N_5, phosphorus pentanitride
c. SF_6, sulfur hexafluoride
d. NO_2, nitrogen dioxide
e. SO, sulfur monoxide

ANS: B DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

82. Name the following oxides of nitrogen in this sequence: NO, N_2O, NO_2, N_2O_4.
a. nitrogen monoxide, dinitrogen monoxide, nitrogen dioxide, dinitrogen tetroxide
b. nitrox, dinitrox, nitridiox, dinitritetrox
c. mononitrogen monoxide, dinitrogen monoxide, mononitrogen dioxide, dinitrogen tetraoxide
d. nitrogen oxide, nitrogen(II) oxide, nitrogen oxide(II), nitrogen(II) oxide(IV)
e. nitrous oxide, nitric oxide, nitrogen dioxide, nitrogen tetraoxide

ANS: A DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

83. Which one of these formula–name combinations is *not* correct?
a. diphosphorus tetroxide: P_2O_4
b. tetraphosphorus nonoxide: P_4O_9
c. diphosphorus pentoxide: P_2O_5
d. tetraphosphorus heptoxide: P_4O_6
e. phosphorus monoxide: PO

ANS: D DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

84. Active metals often form a protective oxide surface film that prevents further reaction of the metal with oxygen in the air. Which one of the following formulas for the metal oxide is *not* correct?
a. Al_2O_3 is aluminum oxide.
b. Fe_2O_3 is iron(III) oxide.
c. Na_2O is sodium oxide.
d. MgO_2 is magnesium oxide.
e. FeO is iron(II) oxide.

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary ionic compound.
MSC: Applying

85. What is the formula for calcium nitride?
a. CaN
b. Ca_2N_3
c. Ca_2N
d. Ca_3N_2
e. CaN_2

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary ionic compound.
MSC: Applying

86. Zinc oxide is found in ointments for the skin. What formula best describes this compound, which has Zn as a doubly charged cation?
a. ZnO
b. Zn_2O
c. ZnO_2
d. Zn_2O_2
e. Zn_2O_3

ANS: A DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of a binary ionic compound.
MSC: Applying

87. Titanium forms different ionic oxides. One, TiO_2, is a white oxide used in paints. What is the proper name for TiO_2?
a. titanium oxide
b. titanium(IV) oxide
c. titanium(II) oxide
d. titanium oxide(II)
e. titanium dioxide

ANS: B DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.
MSC: Applying

88. Manganese(IV) oxide is a brown insoluble solid often found as a product of reactions of potassium permanganate. What is the formula of manganese(IV) oxide?
a. Mn_4O
b. MnO_4
c. MnO
d. MnO_2
e. Mn_2O_2

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.
MSC: Applying

89. What is the correct name for $FeCl_3$?
a. iron(III) chloride
b. iron trichloride
c. ferrum trichloride
d. ferric trichloride
e. iron chloride

ANS: A DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.

MSC: Applying

90. Which one of the following ionic compounds has an *incorrect* formula or is *not* named correctly?
a. CoO, cobalt oxide
b. Co_2O_3, cobalt(III) oxide
c. CoO_2, cobalt(IV) oxide
d. Cu_2S, copper(I) sulfide
e. MgS, magnesium sulfide

ANS: A DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.
MSC: Applying

91. Which anion is *not* labeled correctly?
a. NO_2^- nitrite
b. SO_4^{2-} sulfate
c. Br^- bromide
d. SO_3^{2-} sulfite
e. All are labeled correctly.

ANS: E DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Remembering

92. Which polyatomic ion is *not* labeled correctly?
a. NH_4^+ ammonium
b. ClO_4^- perchlorate
c. CN^- cyanate
d. NO_3^- nitrate
e. All are labeled correctly.

ANS: C DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Remembering

93. Based on its position in the periodic table, which single atom would you predict to form a compound with two nitrate polyatomic ions?
a. boron
b. aluminum
c. lithium
d. calcium
e. carbon

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

94. Based on its position in the periodic table, which single atom would you predict to form a compound with two ammonium ions?
a. boron
b. carbon
c. nitrogen
d. sulfur
e. fluorine

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

95. Sodium nitrite, which is used in meat processing, has been implicated as a possible health hazard because it can react with amines present in meat to form trace quantities of carcinogenic nitrosamines. What is the formula of sodium nitrite?
a. Na_2NO_3
b. $NaNO_2$
c. $NaNO_3$
d. Na_2NO_4
e. Na_2NO_2

ANS: B DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

96. The formula for a terbium phosphate compound is $Tb_3(PO_4)_4$. What would be the formula for a terbium sulfate compound given that the charge of terbium is the same in both compounds?
a. $Tb_2(SO_3)_3$
b. $Tb(SO_4)_2$
c. $Tb(SO_3)_2$
d. $Tb_3(SO_4)_4$
e. $Tb(SO_4)_3$

ANS: B DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

97. The formula for a lutetium carbonate compound is $Lu_2(CO_3)_3$. What would be the formula for a lutetium nitrate compound given that the charge of lutetium is the same in both compounds?
a. $LuNO_3$
b. $Lu(NO_3)_2$
c. $Lu(NO_3)_3$
d. Lu_2NO_3
e. $Lu_2(NO_3)_3$

ANS: C DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

98. Copper(II) sulfate is a common fungicide. What is the correct formula for copper(II) sulfate?
a. $CoSO_4$
b. $CuSO_4$
c. $Cu(SO_3)_2$
d. $CuSO_3$
e. Cu_2SO_4

ANS: B DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

99. Radium often is found in uranium ores and can be separated from solutions by precipitation as radium sulfate. What is the formula for radium sulfate?
a. $RnSO_4$
b. $RaSO_4$
c. Rn_2SO_3
d. Ra_2SO_4
e. $Ra(SO_4)_2$

ANS: B DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

100. What is the correct name for $Ni(NO_2)_2$?
a. nickel dinitrate
b. nickelous nitrite
c. nickel(II) dinitrate
d. nickel(II) nitrite
e. nickel(II) nitrate

ANS: D DIF: Difficult REF: 2.7
OBJ: Convert between the name and the chemical formula of compounds with a polyatomic ion.
MSC: Applying

101. Buffer solutions that maintain certain levels of pH or acidity are widely used in biochemical experiments. One common buffer system uses sodium dihydrogenphosphate and sodium monohydrogenphosphate. What are the formulas of these two compounds?

a. $Na(HPO_4)$ and $Na(HPO_4)_2$
b. NaH_2PO_4 and Na_2HPO_4
c. $Na_2H_2PO_4$ and $NaHPO_4$
d. $NaPO_4$ and $NaHPO_4$
e. $Na_2(HPO_4)_2$ and $Na_2(HPO_4)$

ANS: B DIF: Medium REF: 2.7
OBJ: Convert between name and formula of compounds containing a polyatomic ion.
MSC: Applying

102. The following salts are used in fireworks. Which one has an *incorrect* formula or is *not* named correctly?
a. Li_2CO_3, lithium carbonate
b. $CaSO_4$, calcium sulfate
c. $BaNO_3$, barium nitrate
d. CuO, copper(II) oxide
e. NH_4Cl, ammonium chloride

ANS: C DIF: Easy REF: 2.7
OBJ: Convert between name and formula of compounds containing a polyatomic ion.
MSC: Applying

103. Sulfur combines with oxygen and hydrogen to form two acids. Sulfuric acid has the formula _____, and sulfurous acid has the formula _____.
a. H_2SO_4; H_2SO_3
b. H_2SO_3; H_2SO_4
c. HSO_4; HSO_3
d. HSO_3; HSO_4
e. H_2SO_3; H_2SO_2

ANS: A DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Applying

104. Aqua regia is a mixture of hydrochloric acid and nitric acid that is capable of dissolving gold. What are the formulas of these acids?
a. HClO, HNO_4
b. $HClO_4$, HNO_3
c. HCl, HNO_2
d. HCl, HNO_3
e. HCl, HNO

ANS: D DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Applying

105. Which one of the oxoacid formulas and names is *not* correctly matched?
a. H_2SO_3 sulfurous acid
b. HCl hydrochloric acid
c. H_2SO_4 sulfuric acid
d. HNO_3 nitric acid
e. All are correct.

ANS: E DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Remembering

106. Which one of the following acids has an *incorrect* formula or is *not* named correctly?
a. HI, hydroiodic acid
b. H_2CO_3, carbonic acid
c. HNO_3, nitric acid
d. H_2SO_3, sulfuric acid
e. H_3PO_4, phosphoric acid

ANS: D DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Remembering

107. Which one of the following acids has an *incorrect* formula or is *not* named correctly?
a. HCl, hydrochloric acid
b. HF, hydrofluoric acid
c. HNO_2, nitric acid
d. H_2CO_3, carbonic acid
e. H_2SO_4, sulfuric acid

ANS: C DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Remembering

108. Which one of the following acids is *not* named correctly?
a. H_2SO_3, sulfurous acid
b. H_2S, hydrosulfuric acid
c. H_3PO_3, phosphoric acid
d. HBr, hydrobromic acid
e. HNO_3, nitric acid

ANS: C DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Remembering

109. Hypochlorous acid has the formula _____
a. $HClO_4$.
b. $HClO_3$.
c. $HClO_2$.
d. HClO.
e. H_2ClO_2.

ANS: D DIF: Easy REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Remembering

110. According to the Big Bang theory, which statement about the origin of the elements is *not* correct?
a. Initially, energy was transformed into electrons and other elementary particles.
b. As the universe cooled, neutrons and protons were formed.
c. Collisions of neutrons and protons produced deuterons, which then led to the formation of alpha particles.
d. The nuclides of the elements were formed by nuclear reactions in the interior of stars.
e. These nuclear reactions all require the addition of energy to form the elements.

ANS: E DIF: Medium REF: 2.9
OBJ: Describe the sequence of events that is part of the Big Bang theory.
MSC: Remembering

111. A supernova event is the explosion caused by the collapse of a dying star that has run out of its nuclear fuel. These stars and events are responsible for _____
a. the production of elements heavier than iron-56.
b. nuclear fission of heavy elements.
c. the distribution of heavy elements throughout the universe.
d. both a and c.
e. both b and c.

ANS: D DIF: Medium REF: 2.9
OBJ: Describe the sequence of events that is part of the Big Bang theory.
MSC: Remembering

112. Quarks _____
a. were initially formed along with electrons microseconds after the Big Bang.
b. combined as the universe cooled to form protons and neutrons.

c. are the primary particle involved in nucleosynthesis.
d. both a and b.
e. both b and c.

ANS: D DIF: Medium REF: 2.9
OBJ: Describe the sequence of events that is part of the Big Bang theory.
MSC: Remembering

113. The emission of a β particle is associated with the _____
a. conversion of a neutron to a proton.
b. conversion of a proton to a neutron.
c. increase in mass number.
d. decrease in mass number.
e. formation of an isotope.

ANS: A DIF: Medium REF: 2.9
OBJ: Identify reactants and products in nucleosynthesis. MSC: Remembering

114. Heavy elements in the universe are formed by _____
a. fission reactions of hydrogen nuclei.
b. quark formation.
c. supernova explosions.
d. star collapse into black holes.
e. fusion reactions of iron nuclei.

ANS: E DIF: Medium REF: 2.9
OBJ: Identify reactants and products in nucleosynthesis. MSC: Remembering

115. What is the correct symbol for an alpha particle?
a. ${}^{4}_{1}\alpha$
b. ${}^{2}_{2}\alpha$
c. ${}^{2}_{4}\alpha$
d. ${}^{4}_{2}\alpha$
e. ${}^{0}_{0}\alpha$

ANS: D DIF: Medium REF: 2.9
OBJ: Identify reactants and products in nucleosynthesis. MSC: Remembering

116. Which stellar nuclear reaction is *not* correctly written?
a. ${}^{12}_{6}\mathrm{C} + {}^{4}_{2}\alpha \rightarrow \mathrm{O}$
b. ${}^{32}_{16}\mathrm{S} + {}^{4}_{2}\alpha \rightarrow {}^{36}_{18}\mathrm{Ar}$
c. ${}^{108}_{47}\mathrm{Ag} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{109}_{47}\mathrm{Ag} + {}^{0}_{1-}\beta$
d. ${}^{68}_{30}\mathrm{Zn} + 2{}^{1}_{0}\mathrm{n} \rightarrow {}^{70}_{31}\mathrm{Ga} + {}^{0}_{1-}\beta$
e. ${}^{65}_{29}\mathrm{Cu} + 3{}^{1}_{0}\mathrm{n} \rightarrow {}^{68}_{30}\mathrm{Zn} + {}^{0}_{1-}\beta$

ANS: C DIF: Easy REF: 2.9
OBJ: Write nuclear reaction equations that describe nucleosynthesis.
MSC: Applying

SHORT ANSWER

1. In one sentence, describe the picture of the atom that emerged from the Rutherford–Geiger–Marsden experiment with alpha particles.

ANS:

The atom was pictured as consisting of a tiny, positively charged nucleus surrounded by a diffuse cloud of negatively charged electrons.

DIF: Easy REF: 2.2
OBJ: Describe the evidence obtained from the Rutherford–Geiger–Marsden experiment with alpha particles and how it rejected the plum-pudding model and led to the nuclear model of atomic structure.
MSC: Remembering

2. What distinguishes one isotope from another?

ANS:
Isotopes have the same number of protons but different numbers of neutrons.

DIF: Easy REF: 2.3
OBJ: Write a definition of the term isotope, and identify the feature that distinguishes one isotope from another. MSC: Applying

3. Provide the number of protons, neutrons, and electrons in a silicon-29 isotope.

ANS:
14 protons, 15 neutrons, and 14 electrons

DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

4. Write the complete atomic symbol with both a superscript and a subscript for a sodium ion that contains 11 protons, 10 electrons, and 12 neutrons.

ANS:
$^{23}_{11}Na^{+}$

DIF: Easy REF: 2.3
OBJ: Convert between an atomic symbol and the number of protons, neutrons, nucleons, and electrons comprising an ion. MSC: Applying

5. Nuclear reactors used for power generation require uranium enriched in uranium-235. What is the average atomic mass of enriched uranium consisting of exactly 3.0% uranium-235 (235.04 amu) and 97.0% uranium-238 (238.05 amu)?

ANS:
237.96 amu

DIF: Medium REF: 2.4
OBJ: Use natural abundance data for isotopes to calculate an average atomic mass.
MSC: Applying

6. Boron, which has an average atomic mass of 10.81 amu, has two stable isotopes: boron-10 (19.78%) and boron-11 (80.22%). Boron-10 has an atomic mass of 10.0129 amu; what is the atomic mass of boron-11?

ANS:

11.01 amu

DIF: Medium REF: 2.4
OBJ: Determine the mass of an isotope from the average atomic mass and natural abundances of other isotopes. MSC: Applying

7. Give an example of an alkali metal.

ANS:
Sodium; answers will vary.

DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

8. Give an example of an alkaline earth metal.

ANS:
Calcium; answers will vary.

DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

9. Give an example of a halogen.

ANS:
Bromine; answers will vary.

DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

10. Give an example of a nonmetal.

ANS:
Sulfur; answers will vary.

DIF: Easy REF: 2.5
OBJ: Identify elements as metals, metalloids, and nonmetals, and describe the general differences among these three categories. MSC: Remembering

11. Give an example of a metalloid (a.k.a semimetal).

ANS:
Silicon; answers will vary.

DIF: Easy REF: 2.5
OBJ: Identify elements as metals, metalloids, and nonmetals, and describe the general differences among these three categories. MSC: Remembering

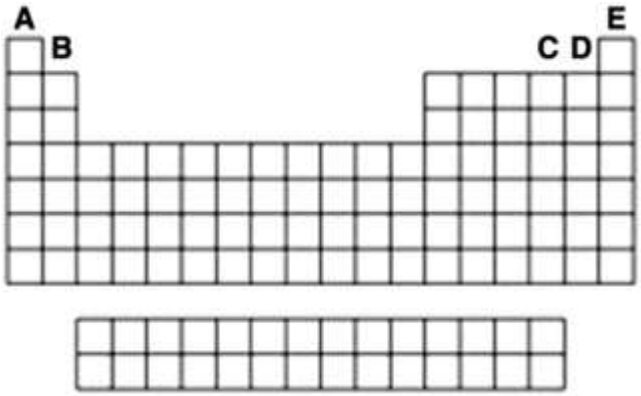
12. Give an example of a transition metal.

ANS:
Iron; answers will vary.

DIF: Easy REF: 2.5 OBJ: Identify the transition metal elements.

MSC: Remembering

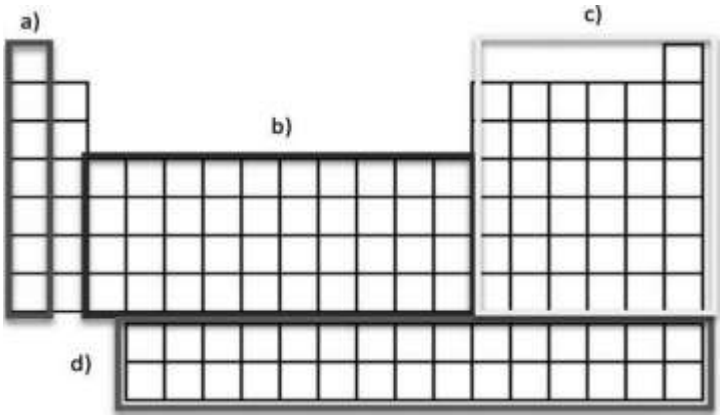
13. Identify the letter that corresponds to each of the following groups of the periodic table:
a) chalcogens b) noble gases c) alkaline earth metals d) halogens



ANS:
a) C b) E c) B d) D

DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

14. Label the highlighted regions of the periodic table.



ANS:
a) alkali metals, b) transition metals, c) main group elements/*p* block, and d) lanthanide and actinides

DIF: Easy REF: 2.5
OBJ: Associate elements with the group to which they belong. MSC: Remembering

15. Nitrogen and oxygen combine to form several different nitrogen oxides. Chemical analysis found that the N:O mass ratio in NO is 0.875. Two other nitrogen oxides were produced by reacting 8.4 g of nitrogen completely with 4.8 g of oxygen in one case and in another case by reacting 4.2 g of nitrogen with 9.6 g of oxygen. What are the empirical formulas of these two nitrogen oxides?

ANS:
N_2O and NO_2

DIF: Difficult REF: 2.6
OBJ: State Dalton's law of multiple proportions, explain its significance, and use it to determine combining ratios of elements in forming compounds. MSC: Applying

16. A cation has a _____ charge, and an anion has a _____ charge.

ANS:
positive ; negative

DIF: Easy REF: 2.6 OBJ: Distinguish between anions and cations.
MSC: Remembering

17. Give an example of a molecular compound (a.k.a. a covalent compound).

ANS:
Carbon dioxide, CO_2; answers will vary.

DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Applying

18. Give an example of an ionic compound.

ANS:
Sodium chloride, NaCl; answers will vary.

DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Applying

19. Identify each of the following compounds as molecular or ionic: a) NO_3 b) $CaCl_2$ c) $Cu(NO_3)_2$ d) CH_3OH.

ANS:
a) molecular b) ionic c) ionic d) molecular

DIF: Easy REF: 2.6
OBJ: Characterize and classify a compound as molecular or ionic.
MSC: Applying

20. What is the chemical formula for hexasulfur monoxide?

ANS:
S_6O

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

21. What is the chemical formula for dinitrogen tetroxide?

ANS:
N_2O_4

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

22. What is the correct name for SO_3?

ANS:
Sulfur trioxide

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

23. What is the correct name for PCl_5?

ANS:
Phosphorus pentachloride

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of a binary molecular compound.
MSC: Applying

24. What is the chemical formula for manganese(IV) oxide?

ANS:
MnO_2

DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.
MSC: Applying

25. What is the chemical formula for potassium sulfite?

ANS:
K_2SO_3

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of compounds with a polyatomic ion.
MSC: Applying

26. What is the chemical formula for calcium nitrite?

ANS:
$Ca(NO_2)_2$

DIF: Easy REF: 2.7
OBJ: Convert between the name and formula of compounds with a polyatomic ion.
MSC: Applying

27. What is the correct name for $CuCl_2$?

ANS:
Copper(II) chloride

DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of transition metal compounds.
MSC: Applying

28. What is the correct name for PbS_2?

ANS:
Lead(IV) sulfide

DIF: Medium REF: 2.7
OBJ: Convert between the name and formula of ionic compounds.
MSC: Applying

29. What is the correct name for the acid HNO_2?

ANS:
Nitrous acid

DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Applying

30. What is the chemical formula for hypochlorous acid?

ANS:
HClO

DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Applying

31. What is the chemical formula for hydroselenic acid?

ANS:
H_2Se

DIF: Medium REF: 2.7
OBJ: Convert between the name and the chemical formula of an acid.
MSC: Applying