2.1 Multiple-Choice Questions

1) What is the chemical symbol for manganese?
   A) Hg  
   B) Mg  
   C) Mn  
   D) Na  
   Answer: C  
   Diff: 2   Var: 1  
   Topic: Section 2.1 Chemistry and the Elements  
   Learning Obj: LO 2.1 Use symbols to represent the elements.  
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

2) Which element has the chemical symbol, P?
   A) lead  
   B) phosphorus  
   C) platinum  
   D) potassium  
   Answer: B  
   Diff: 2   Var: 1  
   Topic: Section 2.1 Chemistry and the Elements  
   Learning Obj: LO 2.1 Use symbols to represent the elements.  
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

3) According to history, the concept that all matter is composed of atoms was first proposed by
   A) the Greek philosopher Democritus, but not widely accepted until modern times.  
   B) Dalton, but not widely accepted until the work of Mendeleev.  
   C) Dalton, but not widely accepted until the work of Einstein.  
   D) Dalton, and widely accepted within a few decades.  
   Answer: A  
   Diff: 1   Var: 1  
   Topic: Section 2.1 Chemistry and the Elements  
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

4) Mendeleev arranged the elements according to
   A) atomic number and atomic weight.  
   B) atomic weight and chemical reactivity.  
   C) electron configuration and atomic weight.  
   D) physical state and relative abundance.  
   Answer: B  
   Diff: 1   Var: 1  
   Topic: Section 2.2 Elements and the Periodic Table  
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.
5) Which is **not** true?
   A) Mendeleev ended each row in his periodic table with an inert gas.
   B) Mendeleev left gaps in his periodic table for undiscovered elements.
   C) Mendeleev ordered the elements in his periodic table by atomic weight.
   D) Mendeleev's periodic table predated the concept of electron configuration.
   Answer: A
   Diff: 1  Var: 1
   Topic: Section 2.2  Elements and the Periodic Table
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

6) The horizontal rows of the periodic table are called
   A) groups.
   B) periods.
   C) triads.
   D) elements.
   Answer: B
   Diff: 1  Var: 1
   Topic: Section 2.2  Elements and the Periodic Table
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

7) The vertical columns of the periodic table are called
   A) groups.
   B) periods.
   C) triads.
   D) elements.
   Answer: A
   Diff: 1  Var: 1
   Topic: Section 2.2  Elements and the Periodic Table
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

8) Most elements in the periodic table are
   A) metals.
   B) non-metals.
   C) noble gases.
   D) semi-metals.
   Answer: A
   Diff: 1  Var: 1
   Topic: Section 2.3  Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.
9) Elements in a periodic group have similar
A) chemical properties.
B) densities.
C) masses.
D) physical properties.
Answer: A

10) Which horizontal row of the periodic table contains the most elements?
A) row 4
B) row 5
C) row 6
D) They all contain the same number of elements.
Answer: C

11) Which of the following statements does not describe a physical property of chlorine?
A) Chlorine combines with sodium to form table salt.
B) The color of chlorine gas is green.
C) The density of chlorine gas at standard temperature and pressure is 3.17 g/L.
D) The freezing point of chlorine is -101°C.
Answer: A

12) Which of the following statements does not describe a chemical property of oxygen?
A) Iron will rust in the presence of oxygen.
B) Oxygen combines with carbon to form carbon dioxide gas.
C) The pressure is caused by collision of oxygen molecules with the sides of a container.
D) When coal is burned in oxygen, the process is called combustion.
Answer: C
13) Which group 5A element is most metallic?
   A) N
   B) P
   C) Sb
   D) Bi
   Answer: D
   Diff: 2    Var: 1
   Topic:  Section 2.3  Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5  Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2  Demonstrate the ability to think critically and employ critical thinking skills.

14) Which group of elements reacts violently with water?
   A) halogens
   B) noble gases
   C) alkali metals
   D) alkaline earth metals
   Answer: C
   Diff: 2    Var: 1
   Topic:  Section 2.3  Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5  Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G1  Demonstrate an understanding of the principles of scientific inquiry.

15) Gaseous elements characterized by low reactivity are found in group ________ of the periodic table.
   A) 5A
   B) 6A
   C) 7A
   D) 8A
   Answer: D
   Diff: 2    Var: 1
   Topic:  Section 2.3  Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5  Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2  Demonstrate the ability to think critically and employ critical thinking skills.

16) The observation that 15.0 g of hydrogen reacts with 120.0 g of oxygen to form 135.0 g of water is evidence for the law of
   A) definite proportions.
   B) energy conservation.
   C) mass conservation.
   D) multiple proportions.
   Answer: C
   Diff: 1    Var: 1
   Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
   Global Obj: G2  Demonstrate the ability to think critically and employ critical thinking skills.
17) The observation that 4.0 g of hydrogen reacts with 32.0 g of oxygen to form a product with O:H mass ratio = 8:1, and 6.0 g of hydrogen reacts with 48.0 g of oxygen to form the same product with O/H mass ratio = 8:1 is evidence for the law of
A) definite proportions.
B) energy conservation.
C) mass conservation.
D) multiple proportions.
Answer: A
Diff: 1 Var: 1
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

18) Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 3.2 g of methane reacts with 12.8 g of oxygen to produce 8.8 g of carbon dioxide?
A) 7.2 g
B) 8.8 g
C) 14.8 g
D) 16.0 g
Answer: A
Diff: 2 Var: 1
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

19) Sodium metal and water react to form hydrogen and sodium hydroxide. If 5.98 g of sodium react with water to form 0.26 g of hydrogen and 10.40 g of sodium hydroxide, what mass of water was consumed in the reaction?
A) 4.68 g
B) 5.98 g
C) 10.14 g
D) 10.66 g
Answer: A
Diff: 2 Var: 1
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
20) A sample of pure lithium carbonate contains 18.8% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?
   A) 9.40%  
   B) 18.8%  
   C) 37.6%  
   D) 75.2%  
   Answer:  B  
   Diff: 3   Var: 1  
   Topic:  Section 2.5  The Law of Multiple Proportions and Dalton's Atomic Theory  
   Learning Obj:  LO 2.8  Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
   Global Obj:  G4  Demonstrate the quantitative skills needed to succeed in chemistry.  

21) A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 45.0 g of calcium fluoride?
   A) 2.56 g  
   B) 7.70 g  
   C) 15.0 g  
   D) 23.1 g  
   Answer:  D  
   Diff: 3   Var: 1  
   Topic:  Section 2.5  The Law of Multiple Proportions and Dalton's Atomic Theory  
   Learning Obj:  LO 2.8  Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
   Global Obj:  G4  Demonstrate the quantitative skills needed to succeed in chemistry.  

22) The observation that hydrogen and oxygen can react to form two compounds with different chemical and physical properties, one having an O:H mass ratio = 8:1 and the other having an O:H mass ratio = 16:1 is consistent with the law of
   A) definite proportions.  
   B) energy conservation.  
   C) mass conservation.  
   D) multiple proportions.  
   Answer:  D  
   Diff: 1   Var: 1  
   Topic:  Section 2.5  The Law of Multiple Proportions and Dalton's Atomic Theory  
   Learning Obj:  LO 2.8  Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
   Global Obj:  G2  Demonstrate the ability to think critically and employ critical thinking skills.  

23) Which of the following statements is not a postulate of Dalton's atomic theory?
   A) Each element is characterized by the mass of its atoms.  
   B) Atoms are composed of protons, neutrons, and electrons.  
   C) Chemical reactions only rearrange atomic combinations.  
   D) Elements are composed of atoms.  
   Answer:  B  
   Diff: 1   Var: 1  
   Topic:  Section 2.5  The Law of Multiple Proportions and Dalton's Atomic Theory  
   Global Obj:  G1  Demonstrate an understanding of the principles of scientific inquiry.
24) Which of the following is a part of Dalton's atomic theory?
A) Atoms are rearranged but not changed during a chemical reaction.
B) Atoms break down during radioactive decay.
C) Atoms contain protons, neutrons, and electrons.
D) Isotopes of the same element have different masses.
Answer: A
Diff: 1 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton's Atomic Theory
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

25) Which of the following is not explained by Dalton's atomic theory?
A) conservation of mass during a chemical reaction
B) the existence of more than one isotope of an element
C) the law of definite proportions
D) the law of multiple proportions
Answer: B
Diff: 1 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton's Atomic Theory
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

26) Elements A and Q form two compounds, AQ and A$_2$Q$_3$. The mass ratio (mass Q)/(mass A) for AQ is 0.574. What is the mass ratio (mass Q)/(mass A) for A$_2$Q$_3$?
A) 0.383
B) 0.861
C) 1.16
D) 2.61
Answer: B
Diff: 2 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton's Atomic Theory
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

27) Elements A and Q form two compounds, AQ and A$_2$Q. Which of the following must be true?
A) (mass Q)/(mass A) is one for AQ, and 1/2 for A$_2$Q.
B) (mass Q)/(mass A) for AQ must equal (mass Q)/(mass A) for A$_2$Q.
C) (mass Q)/(mass A) for AQ must be 2 times (mass Q)/(mass A) for A$_2$Q.
D) (mass Q)/(mass A) for AQ must be 1/2 (mass Q)/(mass A) for A$_2$Q.
Answer: C
Diff: 2 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton's Atomic Theory
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
28) Elements A and Q form two compounds. The ratio \((\text{mass Q})/(\text{mass A})\) for compound one is 0.271 and ratio \((\text{mass Q})/(\text{mass A})\) for compound two is 0.362. If compound one has the chemical formula AQ, what is the chemical formula for compound two?
A) A\(_3\)Q\(_4\)
B) A\(_2\)Q\(_3\)
C) AQ\(_2\)
D) AQ\(_3\)
Answer: A
Diff: 2 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton's Atomic Theory
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

29) The existence of electrons in atoms of all elements was demonstrated by
A) Millikan's oil drop experiment.
B) Rutherford's gold foil experiment.
C) Thomson's cathode ray tube experiment.
D) None of these
Answer: C
Diff: 1 Var: 1
Topic: Section 2.6 Atomic Structure: Electrons
Learning Obj: LO 2.9 Describe Thomson's cathode-ray experiment and what it contributed to the current model of atomic structure. (Figure 2.3)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

30) The charge-to-mass ratio of an electron was established by
A) Millikan's oil drop experiment.
B) Rutherford's gold foil experiment.
C) Thomson's cathode ray tube experiment.
D) None of these
Answer: C
Diff: 1 Var: 1
Topic: Section 2.6 Atomic Structure: Electrons
Learning Obj: LO 2.9 Describe Thomson's cathode-ray experiment and what it contributed to the current model of atomic structure. (Figure 2.3)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

31) The current model of the atom in which essentially all of an atom's mass is contained in a very small nucleus, whereas most of an atom's volume is due to the space in which the atom's electrons move was established by
A) Millikan's oil drop experiment.
B) Rutherford's gold foil experiment.
C) Thomson's cathode ray tube experiment.
D) None of these
Answer: B
Diff: 1 Var: 1
Topic: Section 2.7 Atomic Structure: Protons and Neutrons
Learning Obj: LO 2.11 Describe Rutherford's gold foil experiment and what it contributed to the current model of atomic structure. (Figure 2.5)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.
32) The existence of neutrons in the nucleus of an atom was demonstrated by
A) Millikan’s oil drop experiment.
B) Rutherford’s gold foil experiment.
C) Thomson’s cathode ray tube experiment.
D) None of these
Answer: D
Diff: 1 Var: 1
Topic: Section 2.7 Atomic Structure: Protons and Neutrons
Learning Obj: LO 2.12 Describe the structure and size of the atom. (Figure 2.6)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

33) Most of the alpha particles directed at a thin gold foil in Rutherford’s experiment
A) bounced directly back from the foil.
B) passed directly through the foil undeflected.
C) passed through the foil but were deflected at an angle.
D) were absorbed by the foil.
Answer: B
Diff: 1 Var: 1
Topic: Section 2.7 Atomic Structure: Protons and Neutrons
Learning Obj: LO 2.11 Describe Rutherford’s gold foil experiment and what it contributed to the current model of
atomic structure. (Figure 2.5)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

34) Which subatomic particle has the smallest mass?
A) a proton
B) a neutron
C) an electron
D) an alpha particle
Answer: C
Diff: 2 Var: 1
Topic: Section 2.7 Atomic Structure: Protons and Neutrons
Learning Obj: LO 2.12 Describe the structure and size of the atom. (Figure 2.6)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

35) The symbol that is usually used to represent atomic number is
A) A.
B) N.
C) X.
D) Z.
Answer: D
Diff: 1 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.15 Write isotope symbols for elements.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.
36) The mass number of an atom is equal to the number of
A) electrons.
B) neutrons.
C) protons.
D) protons plus neutrons.
Answer: D
Diff: 1 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

37) Which of the following two atoms are isotopes?
A) \( ^{40} \text{Ar} \) and \( ^{40} \text{Ca} \)
B) \( ^{12} \text{C} \) and \( ^{13} \text{C} \)
C) \( ^{35} \text{Cl} \) and \( ^{80} \text{Br} \)
D) \( ^{24} \text{Mg} \) and \( ^{12} \text{C} \)
Answer: B
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

38) Which of the following represent isotopes?

A: \( ^{25} \text{[} \)  B: \( ^{21} \text{[} \)  C: \( ^{27} \text{[} \)  D: \( ^{25} \text{[} \)

A) A and B
B) A and C
C) A and D
D) C and D
Answer: B
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.15 Write isotope symbols for elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
39) Boron-9 can be represented as
A) \(^9\text{Be}\).
B) \(^9\text{B}\).
C) \(^{14}\text{B}\).
D) \(^{14}\text{B}\).

Answer: B
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.15 Write isotope symbols for elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

40) How many protons (p) and neutrons (n) are in an atom of \(^{90}\text{Sr}\)?
A) 38 p, 52 n
B) 38 p, 90 n
C) 52 p, 38 n
D) 90 p, 38 n
Answer: A
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.15 Write isotope symbols for elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

41) How many protons (p) and neutrons (n) are in an atom of calcium-46?
A) 20 p, 26 n
B) 20 p, 46 n
C) 26 p, 20 n
D) 46 p, 60 n
Answer: A
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
42) What is the chemical symbol for an atom that has 29 protons and 36 neutrons?
A) Cu  
B) Kr  
C) N  
D) Tb  
Answer: A  
Diff: 2  Var: 1  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

43) How many electrons are in a neutral atom of iodine-131?
A) 1  
B) 53  
C) 54  
D) 131  
Answer: B  
Diff: 2  Var: 1  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

44) How many protons (p), neutrons (n), and electrons (e) are in one atom of $^{23}_{12}$Mg?
A) 12 p, 12 n, 12 e  
B) 12 p, 11 n, 12 e  
C) 12 p, 11 n, 10 e  
D) 12 p, 11 n, 14 e  
Answer: B  
Diff: 2  Var: 1  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

45) Identify the chemical symbol of element Q in $^{80}_{34}$Q.
A) Br  
B) Hg  
C) Pd  
D) Se  
Answer: D  
Diff: 2  Var: 1  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.15 Write isotope symbols for elements.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
46) The atoms of a particular element all have the same number of protons as neutrons. Which of the following must be true?
A) The atomic weight must be a whole number.
B) The mass number for each atom must equal the atomic weight of the element.
C) The mass number must be exactly twice the atomic number for each atom.
D) All of these are true.
Answer: C
Diff: 1 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

47) Three atoms have the following properties.

<table>
<thead>
<tr>
<th></th>
<th>Proton</th>
<th>Neutron</th>
<th>Electron</th>
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<tbody>
<tr>
<td>Atom X</td>
<td>119</td>
<td>119</td>
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</tr>
<tr>
<td>Atom Y</td>
<td>119</td>
<td>118</td>
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<tr>
<td>Atom Z</td>
<td>118</td>
<td>118</td>
<td>119</td>
</tr>
</tbody>
</table>

The elements X and Y are best described as
A) isotopes.
B) cations.
C) different elements.
D) anions.
Answer: A
Diff: 2 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
48) Three atoms have the following properties.

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<tr>
<td>Atom Z</td>
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<td>119</td>
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</table>

The elements Y and Z are best described as
A) isotopes.
B) cations.
C) different elements.
D) anions.
Answer: C

49) Three atoms have the following properties.

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</table>

Which of the following statements is true?
A) Element Y and Z are isotopes of X.
B) Element Y is an isotope of Z.
C) Element Y is an ion of X.
D) Element Z is an ion of Y.
Answer: C

50) What is the identity of the element with 6 protons, 7 neutrons, and 6 electrons?
A) C
B) N
C) Al
D) Mg
Answer: A
51) The smallest sample of carbon atoms that can be observed with the naked eye has a mass of approximately $2 \times 10^{-8}$ g. Given that 1 g = $6.02 \times 10^{23}$ amu, and that carbon has an atomic weight of 12.01 amu, determine the number of carbon atoms present in the sample.

A) $1 \times 10^{15}$  
B) $1 \times 10^{16}$  
C) $1 \times 10^{17}$  
D) $6 \times 10^{23}$  

Answer: A  
Diff: 3  Var: 1  
Topic: Section 2.9 Atomic Weights and the Mole  
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

52) An element has two naturally occurring isotopes. One has an abundance of 37.4% and an isotopic mass of 184.953 amu, and the other has an abundance of 62.6% and a mass of 186.956 amu. What is the atomic weight of the element?

A) 185.702 amu  
B) 185.954 amu  
C) 186.207 amu  
D) 186.956 amu  

Answer: C  
Diff: 3  Var: 1  
Topic: Section 2.9 Atomic Weights and the Mole  
Learning Obj: LO 2.16 Calculate atomic weight given the fractional abundance and mass of each isotope.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

53) The element antimony has an atomic weight of 121.757 amu and only two naturally-occurring isotopes. One isotope has an abundance of 57.3% and an isotopic mass of 120.904 amu. Based on these data, what is the mass of the other isotope?

A) 121.757 amu  
B) 122.393 amu  
C) 122.610 amu  
D) 122.902 amu  

Answer: D  
Diff: 3  Var: 1  
Topic: Section 2.9 Atomic Weights and the Mole  
Learning Obj: LO 2.16 Calculate atomic weight given the fractional abundance and mass of each isotope.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
54) What is the mass of one atom of the element hydrogen?
A) 2.0 g
B) 1.0 g
C) $3.4 \times 10^{-24}$ g
D) $1.7 \times 10^{-24}$ g
Answer: D
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

55) How many moles and how many atoms of zinc are in a sample weighing 34.9 g?
A) 0.533 mol, $8.85 \times 10^{-25}$ atoms
B) 0.533 mol, $3.21 \times 10^{23}$ atoms
C) 1.87 mol, $3.10 \times 10^{-24}$ atoms
D) 1.87 mol, $1.13 \times 10^{24}$ atoms
Answer: B
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

56) Steel is galvanized by giving it a surface coating of zinc. Galvanized steel is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: C
Diff: 2 Var: 1
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

57) How many electrons are in the ion, Zn$^{2+}$?
A) 28
B) 30
C) 32
D) 65
Answer: A
Diff: 2 Var: 1
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
58) How many electrons are in the ion, P\(^{3-}\)?
   A) 12
   B) 18
   C) 28
   D) 34
   Answer: B
   Diff: 2 Var: 1
   Topic: Section 2.11 Ions and Ionic Bonds
   Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

59) What is the identity of element Q if the ion Q\(^{2+}\) contains 10 electrons?
   A) C
   B) O
   C) Ne
   D) Mg
   Answer: D
   Diff: 2 Var: 1
   Topic: Section 2.11 Ions and Ionic Bonds
   Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

60) How many electrons are in the ion, CO\(_3\)\(^{2-}\)?
   A) 16
   B) 28
   C) 30
   D) 32
   Answer: D
   Diff: 2 Var: 1
   Topic: Section 2.11 Ions and Ionic Bonds
   Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

61) What type of bonding is found in the compound PCl\(_5\)?
   A) covalent bonding
   B) hydrogen bonding
   C) ionic bonding
   D) metallic bonding
   Answer: A
   Diff: 2 Var: 1
   Topic: Section 2.12 Naming Chemical Compounds
   Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
62) Which of the species below has 28 protons and 26 electrons?
A) Fe$^{2+}$
B) Ni$^{2+}$
C) Fe$^{54}_{26}$
D) Ni$^{54}_{28}$
Answer: B
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

63) Butyric acid has the structural formula given below.

What is the molecular or chemical formula for butyric acid?
A) CHO
B) C$_2$H$_4$O
C) C$_4$H$_8$O$_2$
D) C$_5$H$_8$O$_3$
Answer: C
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

64) The solid compound, Na$_2$CO$_3$, contains
A) Na$^+$, C$^{4+}$, and O$^{2-}$ ions.
B) Na$^+$ ions and CO$_3^{2-}$ ions.
C) Na$_2^+$ and CO$_3^{2-}$ ions.
D) Na$_2$CO$_3$ molecules.
Answer: B
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
65) Which of the following statements concerning ionic compounds is true?
A) Essentially all ionic compounds are solids at room temperature and pressure.
B) Ionic compounds do not contain any covalent bonds.
C) Ionic compounds contain the same number of positive ions as negative ions.
D) The chemical formula for an ionic compound must show a nonzero net charge.
Answer: A
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

66) The gas Freon-11, CCl$_3$F, contains
A) C$^{4+}$, Cl$^{-}$, and F$^{-}$ ions.
B) C$^{4+}$, Cl$_3^{-}$, and F$^{-}$ ions.
C) C$^{4+}$ and Cl$_3$F$^4-$ ions.
D) CCl$_3$F molecules.
Answer: D
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

67) The definitive distinction between ionic bonding and covalent bonding is that
A) ionic bonding involves a sharing of electrons and covalent bonding involves a transfer of electrons.
B) ionic bonding involves a transfer of electrons and covalent bonding involves a sharing of electrons.
C) ionic bonding requires two nonmetals and covalent bonding requires a metal and a nonmetal.
D) covalent bonding requires two nonmetals and ionic bonding requires a metal and a nonmetal.
Answer: B
Diff: 1 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

68) The formula for dinitrogen trioxide is
A) N(OH)$_3$.
B) (NO$_3$)$_2$.
C) N$_2$O$_3$.
D) N$_3$O$_2$.
Answer: C
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
69) The chemical formula for potassium peroxide is
A) KOH.
B) KO₂.
C) K₂O.
D) K₂O₂.
Answer: D
Diff: 2   Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

70) By analogy with the oxoanions of sulfur, H₂TeO₃ would be named
A) hydrotellurous acid.
B) pertelluric acid.
C) telluric acid.
D) tellurous acid.
Answer: D
Diff: 2   Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

71) The ions ClO₄⁻, ClO₃⁻, ClO₂⁻, and ClO⁻ are named respectively
A) hypochlorate, chlorate, chlorite, perchlorite.
B) hypochlorite, chlorite, chlorate, perchlorate.
C) perchlorate, chlorate, chlorite, hypochlorite.
D) perchlorite, chlorite, chlorate, hypochlorite.
Answer: C
Diff: 2   Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

72) The compound, NO₂, is named
A) nitrate.
B) nitrite.
C) nitrogen dioxide.
D) nitrogen(IV) oxide.
Answer: C
Diff: 2   Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
73) The ion NO$_2^-$ is named
A) nitrate ion.
B) nitrite ion.
C) nitrogen dioxide ion.
D) nitrogen(II) oxide ion.
Answer: B
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

74) The thiosulfate ion is
A) HS\(^-\).
B) HSO$_4^{2-}$.
C) SO$_5^{2-}$.
D) S$_2$O$_3^{2-}$.
Answer: D
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

75) KH$_2$PO$_4$ is
A) hydropotassium phosphate.
B) potassium dihydrogen phosphate.
C) potassium diphosphate.
D) potassium hydrogen(II) phosphate.
Answer: B
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

76) What is the name of the compound formed between Ca and N?
A) calcium dinitride
B) calcium trinitride
C) monocalcium trinitride
D) calcium nitride
Answer: D
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
77) How many of the following names are correct?

<table>
<thead>
<tr>
<th>Name</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCl(_5)</td>
<td>potassium pentachloride</td>
</tr>
<tr>
<td>NaCN</td>
<td>sodium cyanide</td>
</tr>
<tr>
<td>KrF(_4)</td>
<td>krypton tetrafluoride</td>
</tr>
<tr>
<td>Fe(NO(_3))(_2)</td>
<td>iron (II) nitrate</td>
</tr>
</tbody>
</table>

A) 1  
B) 2  
C) 3  
D) 4  
Answer: B  

Diff: 2     Var: 1  
Topic: Section 2.12 Naming Chemical Compounds  
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

78) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals  
B) alkaline earth metals  
C) inner transition metals  
D) transition metals  
Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.4 Identify groups as main group, transition metal group, or inner transition group.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
79) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals
B) alkaline earth metals
C) inner transition metals
D) transition metals

Answer: C

80) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases

Answer: C
81) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals  
B) alkaline earth metals  
C) halogens  
D) noble gases  
Answer: B

Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
82) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases

Answer: D

Diff: 2  Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
83) What group of elements does the shaded area in the following periodic table indicate?

A) alkali metals  
B) alkaline earth metals  
C) halogens  
D) noble gases  
Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
84) What group of elements does the shaded area in the following periodic table indicate?

A) gases  
B) metals  
C) nonmetals  
D) semimetals  

Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
85) What group of elements does the shaded area in the following periodic table indicate?

A) gases  
B) metals  
C) nonmetals  
D) semimetals  

Answer: B  

Diff: 2  Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
86) What group of elements does the shaded area in the following periodic table indicate?

A) gases  
B) metals  
C) nonmetals  
D) semimetals  
Answer: C  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

87) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?

A) A  
B) B  
C) C  
D) D  
Answer: B  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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88) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?

A) A  
B) B  
C) C  
D) D  

Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

89) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?

A) A  
B) B  
C) C  
D) D  

Answer: C  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
90) Which element indicated by letter in the following periodic table reacts rapidly with water to form an alkaline solution?

A) A  
B) B  
C) C  
D) D  
Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

91) Which element indicated by letter in the following periodic table reacts rapidly with water to form an alkaline solution?

A) A  
B) B  
C) C  
D) D  
Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
92) Which element indicated by letter in the following periodic table reacts rapidly with water to form an alkaline solution?

A) A  
B) B  
C) C  
D) D  

Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

93) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?

A) A  
B) B  
C) C  
D) D  

Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
94) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?

A) A  
B) B  
C) C  
D) D  

Answer: D  
Diff: 2  Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups. 
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

95) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?

A) A  
B) B  
C) C  
D) D  

Answer: D  
Diff: 2  Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups. 
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
96) Which element indicated by letter in the following periodic table is the poorest conductor of electricity and heat?

A) A  
B) B  
C) C  
D) D  
Answer: C  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

97) Which element indicated by letter in the following periodic table is the best conductor of electricity and heat?

A) A  
B) B  
C) C  
D) D  
Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
98) Which elements commonly form anions?
   A) A and B
   B) A and C
   C) B and D
   D) C and D
   Answer: D
   Diff: 2     Var: 1
   Topic: Conceptual Problems
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

99) Which elements commonly form cations?
   A) A and B
   B) A and C
   C) B and D
   D) C and D
   Answer: A
   Diff: 2     Var: 1
   Topic: Conceptual Problems
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

100) Which elements commonly form covalent bonds?
    A) A and B
    B) A and C
    C) B and D
    D) C and D
    Answer: D
    Diff: 2     Var: 1
    Topic: Conceptual Problems
    Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
    Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
Use the periodic table below to answer the following questions.

101) Which is the correct formula of the binary fluoride of element A?
   A) AF$_2$
   B) AF$_3$
   C) AF$_5$
   D) AF$_6$
   Answer: A
   Diff: 2    Var: 1
   Topic: Conceptual Problems
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

102) Which is the correct formula of the binary fluoride of element B?
   A) BF$_2$
   B) BF$_3$
   C) BF$_5$
   D) BF$_6$
   Answer: B
   Diff: 2    Var: 1
   Topic: Conceptual Problems
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

103) In which pair are both formulas of binary fluorides of element C correct?
   A) CF$_2$ and CF$_3$
   B) CF$_2$ and CF$_6$
   C) CF$_3$ and CF$_5$
   D) CF$_5$ and CF$_6$
   Answer: C
   Diff: 2    Var: 1
   Topic: Conceptual Problems
   Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
104) In which pair are both formulas of binary fluorides of element D correct?
A) DF$_2$ and DF$_3$
B) DF$_2$ and DF$_6$
C) DF$_3$ and DF$_5$
D) DF$_5$ and DF$_6$
Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

105) Which is most likely to form a binary oxide with the formula MO (where M = element A, B, C, or D)?
A) element A
B) element B
C) element C
D) element D
Answer: A
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

106) Which is most likely to form a binary oxide with the formula MO$_3$ (where M = element A, B, C, or D)?
A) element A
B) element B
C) element C
D) element D
Answer: D
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

107) Which is most likely to form a binary oxide with the formula M$_2$O$_3$ (where M = element A, B, C, or D)?
A) element A
B) element B
C) element C
D) element D
Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
108) Which is most likely to form a binary oxide with the formula \( M_4O_{10} \) (where \( M = \) element A, B, C, or D)?
A) element A  
B) element B  
C) element C  
D) element D
Answer: C  
Diff: 2  Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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

A) drawing (2)  
B) drawing (3)  
C) drawing (4)  
Answer: B  
Diff: 2  Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.  
Global Obj: G3 Read and interpret graphs and data.
110) Assume that the mixture of substances in drawing (1) undergoes a chemical reaction. Which of the drawings (2)-(4) represents a product mixture that is consistent with the law of mass conservation?

A) drawing (2)
B) drawing (3)
C) drawing (4)
Answer: C

Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G3 Read and interpret graphs and data.

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

A) drawing a)
B) drawing b)
C) drawing c)
D) drawing d)
Answer: A

Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.
Global Obj: G3 Read and interpret graphs and data.
112) Which of the following drawings depicts a chemical reaction consistent with Dalton’s atomic theory?

A) drawing a)  
B) drawing b)  
C) drawing c)  
D) drawing d)  
Answer: D  
Diff: 2   Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
Global Obj: G3 Read and interpret graphs and data.

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

A) only drawings (2) and (3)  
B) only drawings (2) and (4)  
C) only drawings (3) and (4)  
D) drawings (2), (3), and (4)  
Answer: C  
Diff: 2   Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
Global Obj: G3 Read and interpret graphs and data.
114) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

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

Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.
Global Obj: G3 Read and interpret graphs and data.

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

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

Answer: A
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.
Global Obj: G3 Read and interpret graphs and data.
116) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?

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

Answer: D
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.
Global Obj: G3 Read and interpret graphs and data.

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

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

Answer: D
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.
Global Obj: G3 Read and interpret graphs and data.
118) Which of the above drawings represents a pure element?
A) drawing (a)
B) drawing (b)
C) drawing (c)
Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

119) Which of the above drawings represents a pure compound?
A) drawing (a)
B) drawing (b)
C) drawing (c)
Answer: A
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

120) Which of the above drawings represents a mixture?
A) drawing (a)
B) drawing (b)
C) drawing (c)
Answer: C
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.
121) Which of the following drawings represents a collection of acetylene (C₂H₂) molecules? The shaded spheres represent carbon atoms and the unshaded spheres represent hydrogen atoms.

A) drawing (a)  
B) drawing (b)  
C) drawing (c)  
D) drawing (d)  
Answer: C

Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

122) If unshaded spheres represent sulfur atoms and shaded spheres represent oxygen atoms, which of the following drawings depicts a collection of sulfur trioxide molecules?

A) drawing (a)  
B) drawing (b)  
C) drawing (c)  
D) drawing (d)  
Answer: D

Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.
123) Which of the above drawings represents an Ar atom?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

124) Which of the above drawings represents a Cl\(^{-}\) ion?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: A
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

125) Which of the above drawings represents a Ca\(^{2+}\) ion?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: D
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

126) Which of the above drawings represents a K\(^{+}\) ion?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: C
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.
127) Which of the following figures represents $^3_1$H? Unshaded spheres represent neutrons and shaded spheres represent protons.

A) figure (1)  
B) figure (2)  
C) figure (3)  
D) figure (4)  
Answer: B  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.

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

A) figure (1)  
B) figure (2)  
C) figure (3)  
D) figure (4)  
Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.
129) Which of the following figures represents $^{15}_7$N? Unshaded spheres represent neutrons and shaded spheres represent protons.

A) figure (1)  
B) figure (2)  
C) figure (3)  
D) figure (4)  
Answer: A  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.

130) Give the molecular formula corresponding to the following ball-and-stick molecular representation of vitamin C (ascorbic acid) (gray = C, unshaded = H, black = O). In writing the formula, list the atoms in alphabetical order.

A) CHO  
B) C$_3$H$_4$O$_3$  
C) C$_6$H$_4$O$_6$  
D) C$_6$H$_8$O$_6$  
Answer: D  
Diff: 2 Var: 1  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
131) Give the molecular formula corresponding to the following ball-and-stick molecular representation of naphthalene (gray = C, unshaded = H). In writing the formula, list the atoms in alphabetical order.

A) CH
B) C₅H₄
C) C₁₀H₈
D) C₁₀H₁₀

Answer: C

132) If shaded and unshaded spheres represent atoms of different elements, which of the above drawings most likely represents an ionic compound at room temperature and a pressure of 1 atm?

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

Answer: D
133) If shaded and unshaded spheres represent atoms of different elements, which of the above drawings most likely represents a molecular compound at room temperature and a pressure of 1 atm?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

134) If shaded and unshaded spheres represent atoms of different elements, which of the above drawings most likely represents an ionic compound at room temperature and a pressure of 1 atm?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: A
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

135) If shaded and unshaded spheres represent atoms of different elements, which of the above drawings most likely represents a molecular compound at room temperature and a pressure of 1 atm?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: C
Diff: 2 Var: 1
Topic: Conceptual Problems
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.
2.2 Algorithmic Questions

1) What is the chemical symbol for thallium?
   A) Ti
   B) Tl
   C) Tm
   D) Th
   Answer: B
   Diff: 2 Var: 5
   Topic: Section 2.1 Chemistry and the Elements
   Learning Obj: LO 2.1 Use symbols to represent the elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

2) What is the chemical symbol for arsenic?
   A) Ac
   B) Ar
   C) As
   D) At
   Answer: C
   Diff: 2 Var: 5
   Topic: Section 2.1 Chemistry and the Elements
   Learning Obj: LO 2.1 Use symbols to represent the elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

3) What is the chemical symbol for niobium?
   A) Au
   B) Nb
   C) Pb
   D) Nn
   Answer: B
   Diff: 2 Var: 50+
   Topic: Section 2.1 Chemistry and the Elements
   Learning Obj: LO 2.1 Use symbols to represent the elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

4) What is the chemical symbol for platinum?
   A) Pd
   B) Pr
   C) Pt
   D) Au
   Answer: C
   Diff: 2 Var: 50+
   Topic: Section 2.1 Chemistry and the Elements
   Learning Obj: LO 2.1 Use symbols to represent the elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
5) Which element has the chemical symbol, Au?
A) antimony
B) americium
C) gold
D) lead
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.1 Chemistry and the Elements
Learning Obj: LO 2.1 Use symbols to represent the elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

6) What is the chemical symbol for carbon?
A) Co
B) Cr
C) C
D) Ca
Answer: C
Diff: 2 Var: 5
Topic: Section 2.1 Chemistry and the Elements
Learning Obj: LO 2.1 Use symbols to represent the elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

7) Which element has the chemical symbol, Pb?
A) tin
B) lead
C) mercury
D) potassium
Answer: B
Diff: 2 Var: 5
Topic: Section 2.1 Chemistry and the Elements
Learning Obj: LO 2.1 Use symbols to represent the elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

8) Which element has the chemical symbol, N?
A) nickel
B) niobium
C) nitrogen
D) nobelium
Answer: C
Diff: 2 Var: 5
Topic: Section 2.1 Chemistry and the Elements
Learning Obj: LO 2.1 Use symbols to represent the elements.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
9) Which of the following elements has chemical properties similar to oxygen?
A) neon
B) hydrogen
C) nitrogen
D) tellerium
Answer: D
Diff: 2 Var: 50+
Topic: Section 2.2 Elements and the Periodic Table
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

10) ________ is used in lights and signs.
A) Neon
B) Helium
C) Iodine
D) Silicon
Answer: A
Diff: 2 Var: 50+
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

11) ________ does not combine with any other element.
A) Chlorine
B) Nitrogen
C) Helium
D) Krypton
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

12) Identify a chemical property.
A) tarnishing
B) boiling point
C) taste
D) solubility
Answer: A
Diff: 2 Var: 50+
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
13) ________ is a nonmetal that is a solid at room temperature.
A) Calcium
B) Selenium
C) Bromine
D) Copper
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

14) Rubidium belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas
Answer: A
Diff: 2 Var: 6
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

15) Chlorine belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas
Answer: C
Diff: 2 Var: 5
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

16) Radon belongs to the ________ group of the periodic table.
A) alkali metal
B) alkaline earth metal
C) halogen
D) noble gas
Answer: D
Diff: 2 Var: 6
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
17) Calcium belongs to the ________ group of the periodic table.
A) alkali metal  
B) alkaline earth metal  
C) halogen  
D) noble gas  
Answer: B  
Diff: 2   Var: 5  
Topic: Section 2.3 Some Common Groups of Elements and Their Properties  
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

18) Which of the following elements has chemical properties similar to oxygen?
A) fluorine  
B) hydrogen  
C) nitrogen  
D) sulfur  
Answer: D  
Diff: 2   Var: 5  
Topic: Section 2.3 Some Common Groups of Elements and Their Properties  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

19) Which of the following elements is a gas at room temperature?
A) bromine  
B) iron  
C) krypton  
D) sodium  
Answer: C  
Diff: 2   Var: 5  
Topic: Section 2.3 Some Common Groups of Elements and Their Properties  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

20) Which of the following elements is not a solid at room temperature?
A) Ag  
B) Al  
C) He  
D) Fe  
Answer: C  
Diff: 2   Var: 5  
Topic: Section 2.3 Some Common Groups of Elements and Their Properties  
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
21) Which of the following elements is classified as a semimetal?
A) calcium
B) silicon
C) fluorine
D) uranium
Answer: B

22) Which of the following elements is a good conductor of heat and electricity?
A) carbon
B) chlorine
C) neon
D) zinc
Answer: D

23) Which one of the following elements is a poor conductor of heat and electricity?
A) copper
B) phosphorus
C) iron
D) lead
Answer: B

24) All of the following elements are nonmetals except
A) beryllium.
B) carbon.
C) hydrogen.
D) oxygen.
Answer: A
25) Which of the following underlined items is **not** an intensive property?
   A) the **amount** of gold.
   B) the **color** of copper hydroxide
   C) the **density** of argon
   D) the **melting point** of iron metal
   Answer: A
   Diff: 2 Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

26) Which of the following underlined items is **not** an extensive property?
   A) the **color** of a cobalt compound
   B) the **diameter** of a gold nugget
   C) the **mass** of a diamond
   D) the **volume** of a glucose solution
   Answer: A
   Diff: 2 Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

27) Which group 1A element is **not** a metal?
   A) H
   B) K
   C) Cs
   D) Be
   Answer: A
   Diff: 2 Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

28) Which of the following elements is a liquid at room temperature?
   A) neon
   B) helium
   C) mercury
   D) lithium
   Answer: C
   Diff: 2 Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
29) Which of the following elements is not a solid at room temperature?
   A) Zn
   B) Hg
   C) N
   D) C
   Answer: C
   Diff: 2    Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

30) Which of the following elements is classified as a semimetal?
   A) gold
   B) astatine
   C) osmium
   D) berkelium
   Answer: B
   Diff: 2    Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

31) Which of the following elements is a good conductor of heat and electricity?
   A) silicon
   B) iodine
   C) radon
   D) lead
   Answer: D
   Diff: 2    Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

32) Which one of the following elements is a poor conductor of heat and electricity?
   A) nickel
   B) sulfur
   C) aluminum
   D) lead
   Answer: B
   Diff: 2    Var: 50+
   Topic: Section 2.3 Some Common Groups of Elements and Their Properties
   Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
33) All of the following elements are nonmetals except
A) copper.
B) nitrogen.
C) krypton.
D) phosphorus.
Answer: A

34) Methane and oxygen react to form carbon dioxide and water. What mass of water is formed if 6.4 g of methane reacts with 25.6 g of oxygen to produce 17.6 g of carbon dioxide?
A) 14.4 g
B) 17.6 g
C) 29.6 g
D) 32.0 g
Answer: A

35) Sodium metal and water react to form hydrogen and sodium hydroxide. If 11.96 g of sodium react with water to form 0.52 g of hydrogen and 20.80 g of sodium hydroxide, what mass of water was involved in the reaction?
A) 9.36 g
B) 11.96 g
C) 20.28 g
D) 21.32 g
Answer: A
36) A sample of pure lithium chloride contains 16% lithium by mass. What is the % lithium by mass in a sample of pure lithium carbonate that has twice the mass of the first sample?
   A) 8.20%
   B) 16.4%
   C) 32.8%
   D) 65.6%
   Answer: B
   Diff: 2 Var: 5
   Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

37) A sample of pure calcium fluoride with a mass of 15.0 g contains 7.70 g of calcium. How much calcium is contained in 35.0 g of calcium fluoride?
   A) 1.99 g
   B) 7.70 g
   C) 15.0 g
   D) 18.0 g
   Answer: D
   Diff: 2 Var: 5
   Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

38) Mg can react with HCl to produce the white solid MgCl\(_2\) and H\(_2\) gas. A student mixes 1.99 g of Mg with 5.98 g of HCl. If the mass of the white solid is 7.79 g, then what is the mass of H\(_2\) produced?
   A) 0.0 g
   B) 0.18 g
   C) 2.0 g
   D) 15.76 g
   Answer: B
   Diff: 2 Var: 4
   Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
39) Elements A and Q form two compounds, AQ and A₂Q₃. The mass ratio (mass Q)/(mass A) for AQ is 0.286. What is the mass ratio (mass Q)/(mass A) for A₂Q₃?
A) 0.191  
B) 0.429  
C) 2.33  
D) 5.24  
Answer: B  
Diff: 2 Var: 5  
Topic: Section 2.5 The Law of Multiple Proportions and Dalton’s Atomic Theory  
Learning Obj: LO 2.8 Demonstrate the law of multiple proportions using mass composition of two compounds of the same elements.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

40) A proton is approximately
A) 600 times larger than an electron.  
B) 2000 times larger than an electron.  
C) 700 times smaller than an electron.  
D) 3000 times smaller than an electron.  
Answer: B  
Diff: 2 Var: 50+  
Topic: Section 2.7 Atomic Structure: Protons and Neutrons  
Learning Obj: LO 2.12 Describe the structure and size of the atom. (Figure 2.6)  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

41) Which are isotopes? An atom that has an atomic number of 12 and a mass number of 26 is an isotope of an atom that has
A) an atomic number of 13 and a mass number of 26.  
B) an atomic number of 12 and a mass number of 24.  
C) 12 neutrons and 14 protons.  
D) 12 protons and 14 neutrons.  
Answer: B  
Diff: 2 Var: 5  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.15 Write isotope symbols for elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

42) Which of the following represent isotopes?

A: $^{56}_{26} \text{[ ]}$  
B: $^{56}_{27} \text{[ ]}$  
C: $^{55}_{26} \text{[ ]}$  
D: $^{58}_{28} \text{[ ]}$  

A) A and B  
B) A and C  
C) A and D  
D) C and D  
Answer: B  
Diff: 2 Var: 5  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.15 Write isotope symbols for elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
43) How many protons (p) and neutrons (n) are in an atom of $^{226}_{88}$Ra?

A) 88 p, 138 n
B) 88 p, 226 n
C) 138 p, 88 n
D) 226 p, 88 n
Answer: A

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

A) 20 p, 26 n
B) 20 p, 46 n
C) 26 p, 20 n
D) 46 p, 20 n
Answer: A

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

A) As
B) Nb
C) O
D) W
Answer: A

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

A) 1
B) 53
C) 54
D) 131
Answer: B
47) Identify the chemical symbol of element \( Q \) in \( ^{76}_{34}Q \).

A) As  
B) Mo  
C) Os  
D) Se  
Answer: D  
Diff: 2 Var: 5  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.15 Write isotope symbols for elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

48) Which are isotopes? An atom that has an atomic number of 35 and a mass number of 76 is an isotope of an atom that has

A) an atomic number of 31 and a mass number of 76.  
B) an atomic number of 35 and a mass number of 80.  
C) 41 neutrons and 35 protons.  
D) 41 protons and 35 neutrons.  
Answer: B  
Diff: 2 Var: 12  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

49) The isotope represented by \( ^9_6C \) is named

A) carbon-6.  
B) carbon-3.  
C) carbon-9.  
D) carbon-15.  
Answer: C  
Diff: 2 Var: 9  
Topic: Section 2.8 Atomic Numbers  
Learning Obj: LO 2.15 Write isotope symbols for elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

50) A bottle of pure element was missing part of a label. The label said 2.258 x 1023 atoms. You determine the mass of the elements in the bottle to be 10.51946. What is the identity of this element?

A) B  
B) N  
C) Si  
D) Sr  
Answer: C  
Diff: 3 Var: 4  
Topic: Section 2.9 Atomic Weights and the Mole  
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
51) What is the standard isotope that is used to define the number of atoms in a mole?
A) 14N
B) 12C
C) 9Be
D) 31P
Answer: B
Diff: 1 Var: 50+
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

52) The number of atoms of carbon in 28 g of silicon is
A) 28
B) 28 \times 6.022 \times 10^{22}
C) 2.8 \times 10^{23}
D) 6.022 \times 10^{23}
Answer: D
Diff: 2 Var: 8
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

53) One mole of which element has the smallest mass?
A) Co
B) Zn
C) Ni
D) Ru
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

54) 24.0 g of which element contains the greatest number of atoms?
A) Be
B) C
C) O
D) Na
Answer: A
Diff: 2 Var: 50+
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.17 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.
55) A banana split is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

56) Hydrochloric acid is an example of
A) a compound.
B) an element.
C) an ion.
D) a mixture.
Answer: D
Diff: 2 Var: 5
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

57) Iodine is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: B
Diff: 2 Var: 5
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

58) Water is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: A
Diff: 2 Var: 4
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
59) A cake is an example of
A) a compound.
B) an element.
C) a mixture.
D) an anion.
Answer: C
Diff: 2 Var: 21
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

60) Orange juice is an example of
A) a compound.
B) an element.
C) an ion.
D) a mixture.
Answer: D
Diff: 2 Var: 24
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

61) Aluminum is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: B
Diff: 2 Var: 27
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

62) Ethane is an example of
A) a compound.
B) an element.
C) a mixture.
D) a cation.
Answer: A
Diff: 2 Var: 18
Topic: Section 2.10 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Classify molecular representations of matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
63) In which set do all elements tend to form cations in binary ionic compounds?
A) Li, B, O
B) Mg, Cr, Pb
C) N, As, Bi
D) O, F, Cl
Answer: B
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

64) How many electrons are in the ion, Fe^{2+}?
A) 24
B) 26
C) 28
D) 56
Answer: A
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

65) How many electrons are in the ion, S^{2-}?
A) 14
B) 18
C) 30
D) 34
Answer: B
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

66) In which of the following sets do all species have the same number of electrons?
A) Cl^-, Ar, Ca^{2+}
B) N, O^{2-}, F^-
C) Sc^{3+}, Y^{3+}, La^{3+}
D) Cr, Cr^{2+}, Cr^{3+}
Answer: A
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
67) In which of the following sets do all species have the same number of protons?
   A) At\(^{+}\), Rn, Ra\(^{2+}\)
   B) C, N\(^{3-}\), O\(^{-}\)
   C) CO\(^{3+}\), Rh\(^{3+}\), Ir\(^{3+}\)
   D) Br, Co\(^{2+}\), Co\(^{3+}\)
   Answer: D

68) In which of the following sets do all species have the same number of electrons?
   A) I\(^{-}\), Xe, Cs\(^{2+}\)
   B) C, N\(^{3-}\), O\(^{-}\)
   C) Mg\(^{2+}\), Ca\(^{2+}\), Ba\(^{2+}\)
   D) S, S\(^{2-}\), S\(^{2+}\)
   Answer: A

69) In which of the following sets do all species have the same number of protons?
   A) Br\(^{-}\), Kr, Rh\(^{2+}\)
   B) C, N\(^{3-}\), O\(^{-}\)
   C) Mg\(^{2+}\), Ca\(^{2+}\), Ba\(^{2+}\)
   D) O, O\(^{2-}\), O\(^{2+}\)
   Answer: D

70) What is the identity of element Q if the ion Q\(^{2+}\) contains 18 electrons?
   A) Si
   B) S
   C) Ar
   D) Ca
   Answer: D

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71) How many electrons are in the ion, $\text{SO}_4^{2-}$?

A) 26  
B) 46  
C) 48  
D) 50  

Answer: D  
Diff: 2  Var: 5  
Topic: Section 2.11 Ions and Ionic Bonds  
Learning Obj: LO 2.22 Determine the number of electrons and protons from chemical symbol and charge.  
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

72) In which set do all elements tend to form anions in binary ionic compounds?

A) Cs, B, O  
B) Ca, Zn, Pb  
C) N, Sb, Bi  
D) S, Cl, Br  

Answer: D  
Diff: 2  Var: 5  
Topic: Section 2.11 Ions and Ionic Bonds  
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

73) What type of bonding is found in the compound $\text{NH}_3$?

A) covalent bonding  
B) hydrogen bonding  
C) ionic bonding  
D) metallic bonding  

Answer: A  
Diff: 2  Var: 5  
Topic: Section 2.11 Ions and Ionic Bonds  
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

74) Which one of the following compounds contains ionic bonds?

A) $\text{MgO}$  
B) $\text{HCl}$  
C) $\text{PCl}_3$  
D) $\text{CO}_2$  

Answer: A  
Diff: 2  Var: 5  
Topic: Section 2.11 Ions and Ionic Bonds  
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
75) Which of the following is the correct chemical formula for a molecule of iodine?
A) I
B) I
C) I
D) I
Answer: D
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

76) Which of the compounds, Ca H₂, H₂O, C H₄, XeF₄ are ionic compounds?
A) only C H₄
B) only Ca H₂
C) Ca H₂ and Xe F₄
D) H₂O, C H₄, and XeF₄
Answer: B
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

77) Which of the compounds C₂H₆, CaCl₂, Cu(NO₃)₂, OF₂ are expected to exist as molecules?
A) only C₂H₆
B) C₂H₆ and OF₂
C) C₂H₆, Cu(NO₃)₂, and OF₂
D) CaCl₂ and Cu(NO₃)₂
Answer: B
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

78) Which of the following elements has the least tendency to form an ion?
A) Be
B) H
C) He
D) O
Answer: C
Diff: 2 Var: 5
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
79) The solid compound, $\text{Na}_4\text{SiO}_4$, contains
A) $\text{Na}^+$, $\text{Si}^{4+}$, and $\text{O}^{2-}$ ions.
B) $\text{Na}^+$ ions and $\text{SiO}_4^{4-}$ ions.
C) $\text{Na}_4^+$ and $\text{SiO}_4^{4-}$ ions.
D) $\text{Na}_4\text{SiO}_4$ molecules.
Answer: B

80) What is the chemical formula for nickel(II) phosphate?
A) $\text{Ni}_2\text{P}$
B) $\text{Ni}_2\text{PO}_4$
C) $\text{Ni}_3\text{P}_2$
D) $\text{Ni}_3(\text{PO}_4)_2$
Answer: D

81) What is the charge on the Sc ions in $\text{Sc}_2\text{O}_3$?
A) 2-
B) 1+
C) 2+
D) 3+
Answer: D

82) $\text{Na}_2\text{S}$ is named
A) sodium disulfide.
B) sodium sulfide.
C) sodium(II) sulfide.
D) sodium sulfur.
Answer: B

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83) What is the chemical formula for strontium hydroxide?
A) SrH₂
B) SrOH
C) SrOH₂
D) Sr(OH)₂
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

84) What is the chemical formula for radium hydride?
A) RaH₂
B) RaOH
C) RaOH₂
D) Ra(OH)₂
Answer: A
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

85) An aqueous solution of HCl is named
A) hydrochloric acid.
B) hydrochlorous acid.
C) chloric acid.
D) chlorous acid.
Answer: A
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

86) The chemical formula for the nitrite ion is
A) N²⁻.
B) N³⁻.
C) NO₂⁻.
D) NO₃⁻.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
87) The chemical formula for rubidium peroxide is
A) RbOH.
B) RbO₂.
C) Rb₂O.
D) Rb₂O₂.
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

88) The compound, Cu(IO₃)₂, is named
A) copper iodate(II).
B) copper(I) iodate.
C) copper(I) iodate(II).
D) copper(II) iodate.
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

89) The compound, ClO, is named
A) chlorite.
B) hypochlorite.
C) chlorine monoxide.
D) chlorine (II) oxide.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

90) The ion, NO₂⁻, is named
A) nitrate ion.
B) nitrite ion.
C) nitrogen dioxide ion.
D) nitrogen(II) oxide ion.
Answer: B
Diff: 2 Var: 5
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
91) The chemical formula for chlorous acid is
A) \( \text{HClO}^{(aq)} \).
B) \( \text{HClO}_2^{(aq)} \).
C) \( \text{HClO}_3^{(aq)} \).
D) \( \text{HClO}_4^{(aq)} \).
Answer: B

92) The chemical formula for magnesium nitride is
A) \( \text{Mg(NO}_3)_2 \).
B) \( \text{Mg(NO}_2)_2 \).
C) \( \text{Mg}_3\text{N}_2 \).
D) \( \text{MgN}_2 \).
Answer: C

93) In which set do all elements tend to form cations in binary ionic compounds?
A) Na, B, S
B) Ca, Cr, Pb
C) S, As, Bi
D) O, Br, I
Answer: B

94) In which set do all elements tend to form anions in binary ionic compounds?
A) C, S, Pb
B) K, Fe, F
C) Na, Ba, Al
D) N, O, Cl
Answer: D
95) What is the most likely charge on an ion of phosphorus, P?
A) 5-
B) 3-
C) 1+
D) 5+
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

96) Which element can form more than one kind of monatomic ion?
A) Sr
B) Al
C) Sn
D) O
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

97) Which element can form more than one kind of monatomic ion?
A) Na
B) I
C) Cr
D) Zn
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

98) Which one of the following compounds contains ionic bonds?
A) MgS
B) HF
C) NCl₃
D) SiO₂
Answer: A
Diff: 2 Var: 48
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
99) Which of the following is the correct chemical formula for a molecule of nitrogen?
A) N
B) N
C) N
D) N
Answer: D
Diff: 2 Var: 7
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

100) Which of the compounds, Na₃P, PH₃, C₂H₆, IBr₃, are ionic compounds?
A) only C₂H₆
B) only Na₃P
C) Na₃P and PH₃
D) PH₃, C₂H₆, and IBr₃
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

101) Which of the compounds, C₅H₁₂, CaF₂, Pd(NO₃)₂, OCl₂, are expected to exist as molecules?
A) only C₅H₁₂
B) C₅H₁₂ and OCl₂
C) C₅H₁₂, Pd(NO₃)₂, and OCl₂
D) CaF₂ and Pd(NO₃)₂
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.26 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

102) Which of the following elements has the least tendency to form an ion?
A) Ca
B) Li
C) Kr
D) S
Answer: C
Diff: 2 Var: 50+
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
103) What is the chemical formula for iron(II) phosphate?
A) Fe₂P
B) Fe₂PO₄
C) Fe₃P₄
D) Fe₃(PO₄)₂
Answer: D

104) What is the charge on the In in the ionic compound In₂Te₃?
A) 2-
B) 1+
C) 2+
D) 3+
Answer: D

105) Na₂O is named
A) sodium dioxide.
B) sodium oxide.
C) sodium(II) oxide.
D) sodium oxygen.
Answer: B

106) What is the chemical formula for cesium bicarbonate?
A) Cs₂HCO₃
B) CsHCO
C) CsHCO₂
D) CsHCO₃
Answer: D
107) What is the chemical formula for calcium chromate?
A) CaCrO₂
B) CaCrO
C) CaCrO₃
D) CaCrO₄
Answer: D
Diff: 2 Var: 27
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

108) The chemical formula for the carbonate ion is
A) C⁻.
B) CO⁻.
C) CO₃²⁻.
D) CO₂²⁻.
Answer: C
Diff: 2 Var: 32
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

109) The compound, Sn(IO₃)₂, is named
A) tin iodate(II).
B) tin(I) iodate.
C) tin(I) iodate(II).
D) tin(II) iodate.
Answer: D
Diff: 2 Var: 24
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

110) The chemical formula for calcium telluride is
A) Ca(TeO₃).
B) Ca(TeO₂).
C) CaTe.
D) CaTe₂.
Answer: C
Diff: 2 Var: 24
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
111) What are the names of the ions Mn$^{2+}$, Sn$^{2+}$, and Se$^{2-}$?
A) manganese, tin, and selenium
B) manganese, tin(II), and selenide
C) manganese(II), tin(II), and selenium(II-)
D) manganous, stannous, and selenide
Answer: B

112) Which drawing represents the ionic compound Sr$_3$(PO$_4$)$_2$?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: D

113) Which drawing represents the ionic compound Ag$_2$CO$_3$?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
114) Which drawing represents the ionic compound BaF$_2$?
A) drawing (a)  
B) drawing (b)  
C) drawing (c)  
D) drawing (d)  
Answer: C  
Diff: 3  Var: 36  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.

115) Which drawing represents the ionic compound AgClO$_3$?
A) drawing (a)  
B) drawing (b)  
C) drawing (c)  
D) drawing (d)  
Answer: A  
Diff: 3  Var: 21  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.

116) Which drawing represents the ionic compound RbClO$_4$?
A) drawing (a)  
B) drawing (b)  
C) drawing (c)  
D) drawing (d)  
Answer: A  
Diff: 3  Var: 15  
Topic: Conceptual Problems  
Learning Obj: LO 2.20a Convert between structural formulas, ball-and-stick models, and chemical formulas.  
Global Obj: G3 Read and interpret graphs and data.

2.3 Short Answer Questions

1) The symbol for mercury is _______.  
Answer: Hg  
Diff: 2  Var: 1  
Topic: Section 2.1 Chemistry and the Elements  
Learning Obj: LO 2.1 Use symbols to represent the elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

2) Pb is the symbol for the element _______.  
Answer: lead  
Diff: 2  Var: 1  
Topic: Section 2.1 Chemistry and the Elements  
Learning Obj: LO 2.1 Use symbols to represent the elements.  
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
3) In a periodic table rows are called _______ and columns are called _______.
Answer: periods, groups
Diff: 2 Var: 1
Topic: Section 2.2 Elements and the Periodic Table
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

4) The element Al can be found in period _______ and group _______ of the periodic table.
Answer: 3, 3A
Diff: 2 Var: 16
Topic: Section 2.2 Elements and the Periodic Table
Learning Obj: LO 2.2 Identify the location of metals, nonmetals, and semimetals on the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

5) The element that is in period 5 and group 2A has the symbol _______.
Answer: Sr
Diff: 2 Var: 16
Topic: Section 2.2 Elements and the Periodic Table
Learning Obj: LO 2.3 Indicate the atomic number, group number, and period number for an element whose position in the periodic table is given.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

6) A property that depends on the amount of a substance is an _______ property, whereas a property that is independent on the amount of substance is an _______ property.
Answer: extensive, intensive
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

7) Elements are classified as metals, nonmetals, or semimetals. At room temperature a certain element exists as a dull yellow solid that is a poor conductor of electricity and is brittle. This element is most likely a _______.
Answer: nonmetal
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Use the properties of an element to classify it as metal, nonmetal, or semimetal and give its location in the periodic table.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

8) Sodium is an example of an _______ metal that reacts with water to form hydrogen gas and an _______ solution.
Answer: alkali, alkaline (basic)
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
9) 81 g of HBr react with 40 g of NaOH to produce 18 g of H₂O, then the number of grams of NaBr produced is ________.

HBr + NaOH → H₂O + NaBr

Answer: 103 g
Diff: 2 Var: 1
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

10) According to the law of multiple proportions, if 12 g of carbon combine with 16 g of oxygen to form CO, the number of grams of carbon that combine with 16 g of oxygen in the formation of CO₂ is ________.

Answer: 6 g
Diff: 2 Var: 1
Topic: Section 2.5 The Law of Multiple Proportions and Dalton’s Atomic Theory
Learning Obj: LO 2.7 Determine the mass of the products in a reaction using the law of mass conservation.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

11) The charge to mass ratio of an electron was determined from Rutherford’s cathode-ray tube experiment to be 1.759 × 10⁸ C/g and the charge on a single electron was determined from the Millikan oil drop experiment to be 1.602 × 10⁻¹⁹ C, so the mass of a single electron is ________.

Answer: 9.11 × 10⁻²⁸ g
Diff: 3 Var: 1
Topic: Section 2.6 Atomic Structure: Electrons
Learning Obj: LO 2.10a Describe Milikan’s oil drop experiment and what it contributed to the current model of atomic structure. (Figure 2.4)
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

12) The subatomic particles contained in the nucleus of an atom are ________ and ________.

Answer: protons, neutrons
Diff: 1 Var: 1
Topic: Section 2.7 Atomic Structure: Protons and Neutrons
Learning Obj: LO 2.12 Describe the structure and size of the atom. (Figure 2.6)
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

13) Atoms of the same element always have the same number of ________ in their nuclei.

Answer: protons
Diff: 1 Var: 1
Topic: Section 2.8 Atomic Numbers
Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.
14) Isotopes have the same number of ________ but different numbers of ________ in their nuclei.
   Answer: protons, neutrons
   Diff: 1   Var: 1
   Topic: Section 2.8 Atomic Numbers
   Learning Obj: LO 2.15 Write isotope symbols for elements.
   Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

15) The symbol of the isotope having \( Z = 88 \) and \( A = 226 \) is ________.
   Answer: \(^{226}_{88}\)Ra
   Diff: 2   Var: 1
   Topic: Section 2.8 Atomic Numbers
   Learning Obj: LO 2.15 Write isotope symbols for elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

16) The symbol for technetium-98 is ________.
   Answer: \(^{98}_{43}\)Tc
   Diff: 2   Var: 1
   Topic: Section 2.8 Atomic Numbers
   Learning Obj: LO 2.15 Write isotope symbols for elements.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

17) The number of neutrons in a neutral atom of uranium-238 is ________.
   Answer: 146
   Diff: 2   Var: 1
   Topic: Section 2.8 Atomic Numbers
   Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

18) A neutral atom with atomic number 5 and mass number 11 contains ________ electrons.
   Answer: 5
   Diff: 2   Var: 1
   Topic: Section 2.8 Atomic Numbers
   Learning Obj: LO 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
   Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

19) Chlorine has two common isotopes, chlorine-35 and chlorine-37, and an atomic mass of 35.45 amu. The natural abundance of chlorine-35 is ________ (greater than, less than, the same as) the natural abundance of chlorine-37.
   Answer: greater than
   Diff: 2   Var: 1
   Topic: Section 2.9 Atomic Weights and the Mole
   Learning Obj: LO 2.16 Calculate atomic weight given the fractional abundance and mass of each isotope.
   Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.
20) The number of atoms in 1 g of H is ________ (greater than, less than, the same as) the number of atoms in 12 g of C.
Answer: the same as

21) To the nearest whole number, the number of grams of Ba in 3.25 mol of Ba is ________.
Answer: 446 g

22) The number of moles of Li in 34.7 g Li is ________.
Answer: 5.00 mol

23) 10% saline solution (sodium chloride dissolved in water) is an example of a ________.
Answer: mixture

24) The number of electrons in the ion Ca$^{2+}$ is ________.
Answer: 18

25) The number of electrons in the ion C$^{4-}$ is ________.
Answer: 10
26) The bonding in NaI is ________, whereas the bonding in NH₃ is ________.
Answer: ionic, covalent
Diff: 2 Var: 50+
Topic: Section 2.11 Ions and Ionic Bonds
Learning Obj: LO 2.21 Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

27) Phosphate ion has the formula ________.
Answer: PO₄³-
Diff: 2 Var: 1
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.25 Convert between formula and name for ionic compounds with polyatomic ions.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

28) The formula of thallium(III) selenide contains ________ thallium(III) and ________ selenide ions.
Answer: 2, 3
Diff: 2 Var: 16
Topic: Section 2.12 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.