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Experiment 2:
A Submarine Adventure: Density Saves the Day

Instructor Notes and Lab Preparation

Chemicals and Equipment

Various metal shapes of copper, nickel, lead, aluminum, brass, iron, and magnesium
10 mL graduated cylinder
100 mL graduated cylinder
Large tub of salt water (NaCl)
Round balloons
Disposable pipettes and bulbs
¼ ounce fishing weight egg pellets
Vernier calipers
Analytical balance

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Preparation

There is very little preparation for this lab. The glassware and equipment above should be available to each student.

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I have left the shape of the unknown metal objects up to the discretion of the instructor. I have most commonly used cylinders, but even balled up wire will work. The metal unknowns should be constructed such that each metal either has a different dimension or shape or is stamped with a code to differentiate them. Some of the metals should be either too large or too oddly shaped to measure by use of the calipers so that each student must calculate the volume by difference at least once.

The concentration of the salt in the ocean water is also up to the discretion of the instructor. I would suggest a density of about 1.2 g/mL. To save money, table salt or rock salt can be used instead of reagent-grade NaCl. For the reservoir, you can use a 5 L beaker or a plastic tub. Simply dissolve the desired amount of NaCl in distilled water to create the "ocean." I generally have the prep person take a sample of the prepared "ocean" and calculate the density so that I have a relative value to expect from the students.

Instruction Notes

This lab experiment normally takes about 2 hours for the students to complete both parts.

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Part 1

For the best results in part 1, you should separate the metal unknowns into two groups: those whose volume can be determined by calculation and those whose volume must be determined by displacement. I generally have the students take one of each for investigation. The prelab determines the possible identities of the metal unknowns. If you would like to use other metals, the densities of those metals would simply need to be made available to the students.

A key teaching point in this part of the experiment is a discussion regarding which method of volume determination is more accurate. The metals over time tend to become scratched and dented so that the volume by displacement is more accurate. But students often think that the more numbers they collect, the more accurate their data become.

Another key point is the discussion of observation to assist in the identification of the metals. Obviously, copper and brass unknowns could probably be identified by their color alone. A discussion about how a scientist uses all of his or her senses to investigate a subject can be incorporated into the experiment.

Potential Problems

The greatest difficulty can arise when the students forget the difference between diameter and radius in their calculations. A reminder at the beginning of the lab session generally keeps the students straight on this point. Also, the prelaboratory exercise should be checked to make sure that the values the students transfer into their lab notebooks are accurate enough to use for their conclusions.

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Part 2

The creation of the submarine, while silly, seems to really firm up the concept of density in the minds of the students in my labs. One of the main teaching points is the relationship between the mass and volume and how a change in either can cause a shift in the density. A good discussion point is which change has a greater impact. Even though the weight of 20 quarter-ounce lead pellets is well over 100 g, the total volume of the balloon and thus its diameter is still pretty small. Because they often must adjust their sub's volume to get a good submarine, students start to get a feel for how a very small adjustment in the volume can lead to big changes in density. A good submarine will very seldom end up floating exactly in the middle of the beaker/tub of water. A good submarine is a balloon that is completely below the water line with just the knot of the balloon touching the surface.

Potential Problems

Although we use round balloons, when they are blown up, they are still fairly small and thus not quite round in shape. The best way to get a good balloon volume is to set the calipers to the measured balloon diameter desired and lay it flat on the counter or table top. Then blow the balloon up as close as possible to that diameter while pressing the balloon into as round a shape as possible. Only once the correct diameter is achieved should the balloon be tied off.

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The egg weights we use are quarter-ounce lead egg sinkers. The company we use is http://www.bulletweights.com/Products/Lead/eggsinkers.aspx. You can also use marbles to represent the passengers on the sub, but the number required to get a sufficient weight is often difficult to get into the balloon.

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Experiment 2

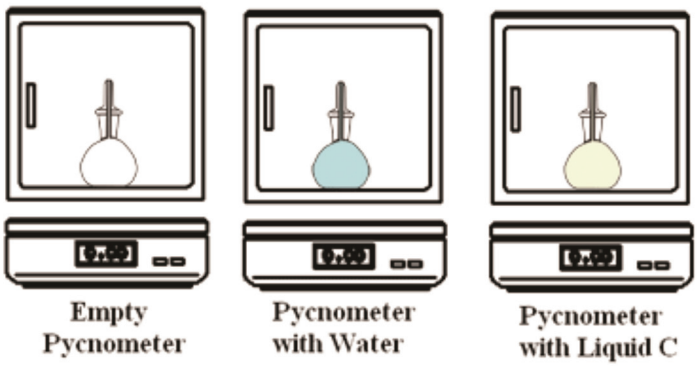
Prelaboratory Assignment KEY

Name: _____ **Date:** _____

Instructor: _____ **Sec. #:** _____

Show all work for full credit.

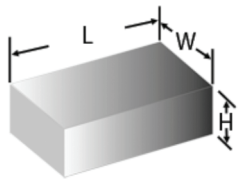
1) A pycnometer with a mass of 56.96 g when empty, has a mass of 108.22 g when filled with water (density = 1.000 g/mL), and a mass of 97.56 g when filled with liquid C.



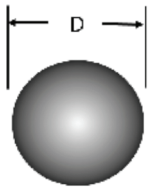
(a) What is the volume of the pycnometer? **51.26 mL**

(b) What is the density of liquid C? **0.7920 g/mL**

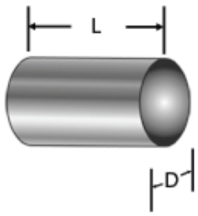
2) Finding the density of solids requires a method of measuring the volume of the solid. If the solid has a regular geometric shape, the volume can be calculated from a measurement of the dimensions of the shape. Examples of three simple shapes are shown here, with the formulas for calculating their volumes.



Rectangular Block



Sphere



Cylinder

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$V = L \times W \times H$	$V = \frac{4}{3}\pi\left(\frac{D}{2}\right)^3$	$V = \pi\left(\frac{D}{2}\right)^2 \times L$

You measure the following dimensions of a rectangular metal block of metal A:
length = 10.89 cm; width = 6.49 cm; height = 1.57 cm. It has a mass of 193.07 g.

What is the density of metal A? **1.74 g/cm^3**

A sphere of metal B has a mass of 298.15 g and a diameter of 3.09 cm.

What is the density of metal B? **19.3 g/cm^3**

You measure the following dimensions of a cylinder of metal C:
length = 9.49 cm; diameter = 2.35 cm. It has a mass of 469.24 g.

What is the density of metal C? **11.4 g/cm^3**

Metal	Density (g/cm^3)*
Nickel	8.90
Lead	11.4
Aluminum	2.70
Gold	19.3
Brass	8.51
Copper	8.92
Iron	7.86
Magnesium	1.74

Based on the densities in the table, identify the unknown metals A, B, and C:

Metal A = **magnesium**

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Metal B = **gold**

Metal C = **lead**

3) You determine that the salt water in the tank has a density of 1.02 g/mL. The balloon weighs 2.0 g, and your weights have a mass of 30.0 g each. If you put six weights in your balloon, you must inflate the balloon to what diameter for it to have a density equal to the salt water, and therefore float in the middle of the tank?

6.98 cm

Lab Report Key

The title page should include:

Student's full name
Date of experiment
Complete title of lab report
Name of partner(s)

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Instructor's name
Lab and section number

The purpose should include:
This experiment deals with several subjects, including density, balance use, caliper use, and measurements of volumes and masses using balances and graduated cylinders. The purpose should include references to most of these topics and should not be a copy of what is given in the manual. Full credit can be given if at least three of the aforementioned topics are discussed.

Procedure:

This should be an MLA form reference to the lab manual with any changes in the procedure noted.

Data:

The data section should include all observations made during the lab of the cylinders, balloons, and anything else involved in the experiment. A data table for determining the density of a metal cylinder should also be included with the following information **a)** measurements of the cylinders, **b)** volume of both cylinders, **c)** mass of the cylinders **d)** density of the cylinders, and **e)** identity of unknown metals.

A second data table with the submarine data should be included. Be sure that the table includes the following information: **a)** mass of graduated cylinder, **b)** volume of ocean water, **c)** mass of water, **d)** weight of balloon with weights, **e)** density of ocean water, **f)** volume of balloon needed to match salt water density, **g)** final volume of submarine design, and **h)** final density of submarine design.

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Calculations:

The calculations section should have example calculations of the following: **a)** volume of the cylinders, **b)** mass of water, **c)** density of ocean water, **d)** volume of balloon needed to match salt water density, **e)** final volume of submarine, and **f)** final density of submarine. Units must be used correctly in all tables and calculations.

Conclusions:

The conclusion section should be in paragraph format. This section should summarize the information in the data section. For the density of the metal cylinder section, there should be a report of the density and identity of the unknown metals. There should be a discussion of any differences in the known and unknown density and the percent error. Also any experimental errors that might have led to these differences should be discussed.

For the submarine data, a report of the density of the ocean water, the ideal volume of the submarine, and the final volume and density of the submarine should be present. A description of

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the trial and error portion of making the submarine and the differences in the ideal volume of the submarine and the final volume of the submarine should be presented. Finally, a discussion of any errors in the submarine design and the experiment should be included.

Questions:

1) Give an example of the use of density (other than submarines) that you have observed in your own life.

   This could be salad dressing, hot air balloons, etc. Anything reasonable can apply.

2) What is third-person writing, and why is it used in the writing of scientific papers?

   When writing, "person" refers to the point of view of the author. First person is written from the "I" point of view, second person is written from the "we" point of view, and third person is written from the "it" point of view. Because much of science is collaborative in nature, most all papers are written without personalization of the text, i.e., from the third person neutral point of view. Writing from the first or second person implies that none of the information in the paper was contingent on any research/work done previously, which is seldom true.

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Experiment 2: A Submarine Adventure: Density Saves the Day		
Section	**Points Worth**	**Points Earned**
Title page (name, title, date, TA, course, section, partner's name)		
Purpose (at least three points)		
Procedure (cited/changes)		
Data (observations)		
Table I (measurements, volumes, mass, density, metal #, ID)		
Table II (m ass graduated cylinder, volume water, mass water, density water, mass of balloon, volume of balloon, final volume and density)		
Calculations (volume by displacement and measurement, density, mass of water, density of water, balloon volume needed, final volume and density of submarine)		
Conclusions (ID and density, differences in known and unknown values, density of ocean water, ideal volume, final volume and density, trial and error discussions, errors)		
Questions		
Total	**100**	
Grade	/	%

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Calculations (volume by displacement and measurement, density, mass of water, density of water, balloon volume needed, final volume and density of submarine)		
Conclusions (ID and density, differences in known and unknown values, density of ocean water, ideal volume, final volume and density, trial and error discussions, errors)		
Questions		
Total	**100**	
Grade	/	%

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Grade	/	%

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***Chemistry, 8e* (Robinson/McMurry/Fay)**
Chapter 2 Atoms, Molecules, and Ions

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 Write symbols to represent element names.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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
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Learning Obj: LO 2.1 Write symbols to represent element names.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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.

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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: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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.

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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 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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9) Elements in a periodic group have similar
A) chemical properties.
B) densities.
C) masses.
D) physical properties.
Answer: A
Diff: 1 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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
Diff: 1 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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 chorine 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
Diff: 1 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.

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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
Diff: 1 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.
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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.
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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.
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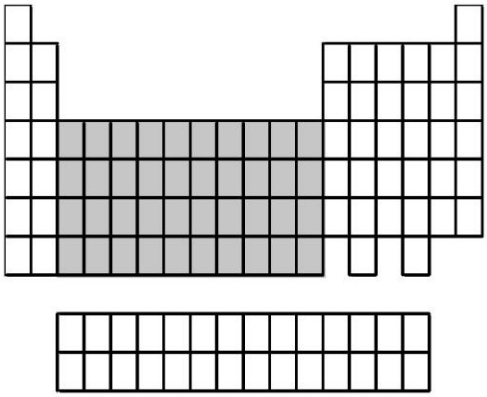
16) What group of elements does the shaded area in the following periodic table indicate?



A) alkali metals
B) alkaline earth metals
C) inner transition metals
D) transition metals
Answer: D
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
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.

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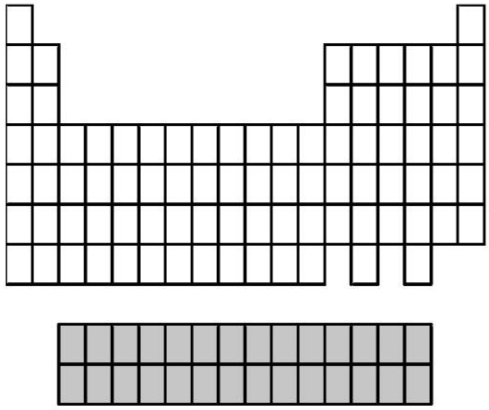
17) What group of elements does the shaded area in the following periodic table indicate?



A) alkali metals
B) alkaline earth metals
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Answer: C
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
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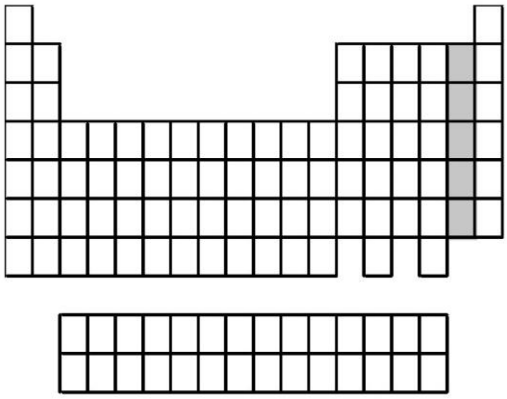
18) What group of elements does the shaded area in the following periodic table indicate?



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

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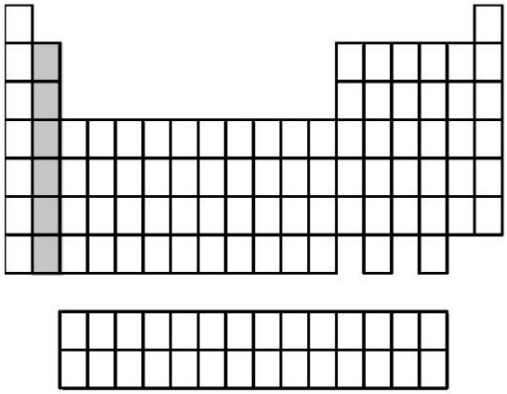
19) What group of elements does the shaded area in the following periodic table indicate?



A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases
Answer: B
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
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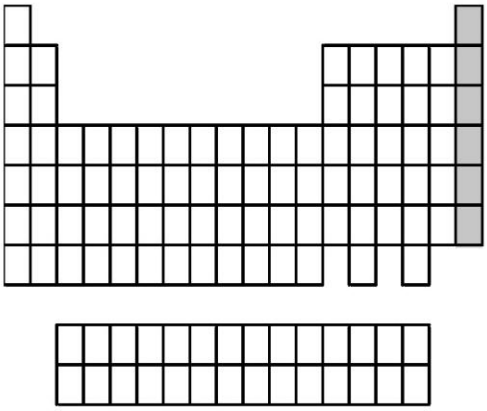
20) What group of elements does the shaded area in the following periodic table indicate?



A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases
Answer: D
Diff: 2 Var: 1
Topic: 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.

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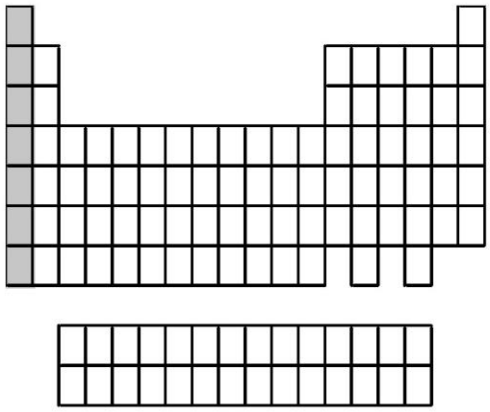
21) What group of elements does the shaded area in the following periodic table indicate?



A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases
Answer: A
Diff: 2 Var: 1
Topic: 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.

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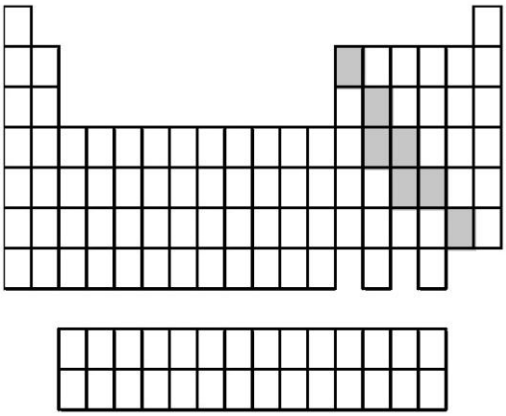
22) What group of elements does the shaded area in the following periodic table indicate?



A) gases
B) metals
C) nonmetals
D) semimetals
Answer: D
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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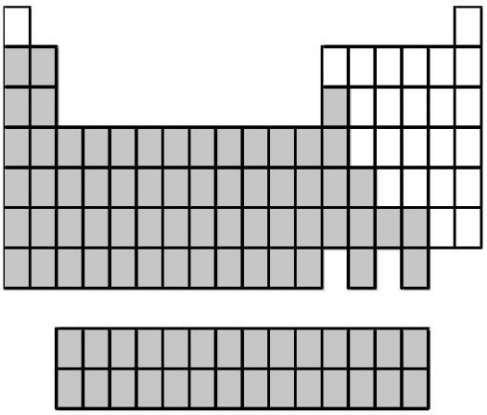
23) What group of elements does the shaded area in the following periodic table indicate?



A) gases
B) metals
C) nonmetals
D) semimetals
Answer: B
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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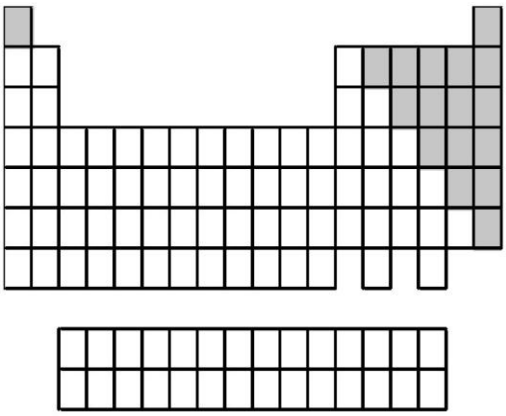
24) What group of elements does the shaded area in the following periodic table indicate?



A) gases
B) metals
C) nonmetals
D) semimetals
Answer: C
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
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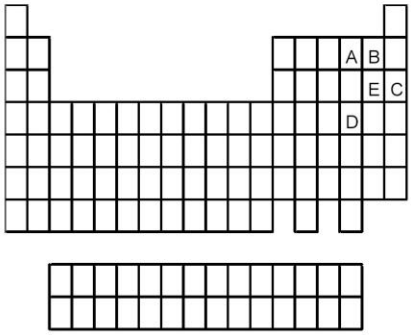
25) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?



A) A
B) B
C) C
D) D
Answer: B
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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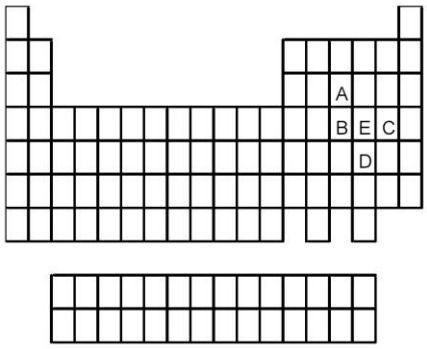
26) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?



A) A
B) B
C) C
D) D
Answer: D
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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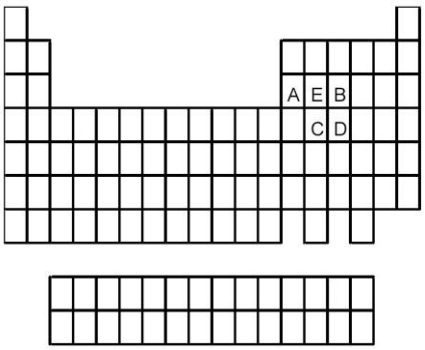
27) Which element is most chemically similar to the element indicated by the letter E in the following periodic table?



A) A
B) B
C) C
D) D
Answer: C
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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

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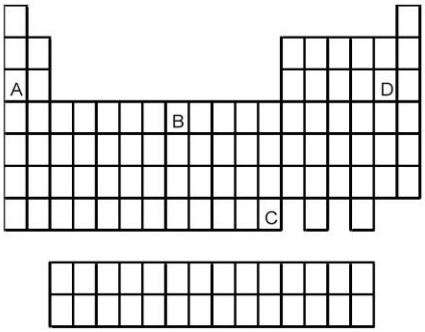

A) A
B) B
C) C
D) D
Answer: A
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.5 Specify the location and give examples of elements in the alkali metal, alkaline earth metal, halogen, and noble gas groups.
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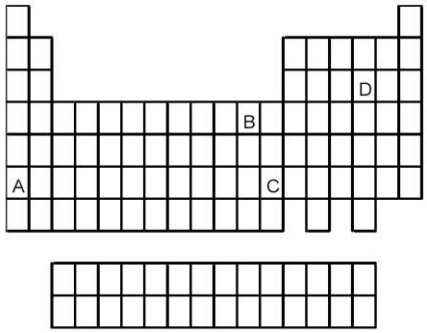
29) Which element indicated by letter in the following periodic table reacts rapidly with water to form an alkaline solution?



A) A
B) B
C) C
D) D
Answer: A
Diff: 2 Var: 1
Topic: 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.

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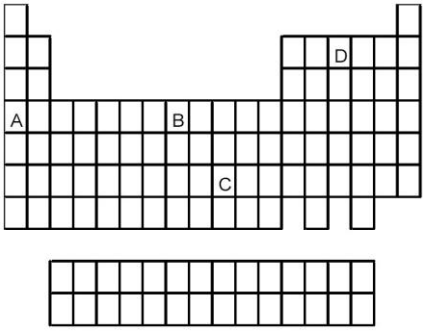
30) Which element indicated by letter in the following periodic table reacts rapidly with water to form an alkaline solution?



A) A
B) B
C) C
D) D
Answer: A
Diff: 2 Var: 1
Topic: 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.
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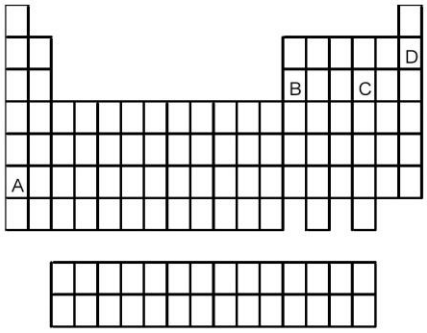
31) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?



A) A
B) B
C) C
D) D
Answer: D
Diff: 2 Var: 1
Topic: 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.

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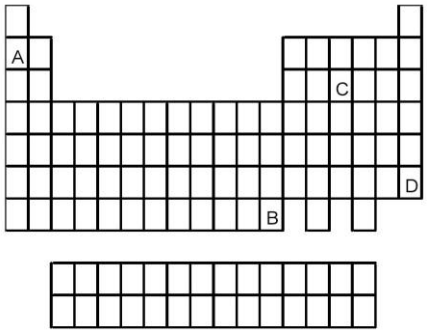
32) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?



A) A
B) B
C) C
D) D
Answer: D
Diff: 2 Var: 1
Topic: 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.
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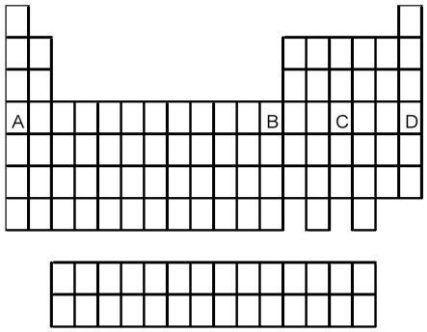
33) Which element indicated by letter in the following periodic table is a gas at room temperature and a pressure of 1.0 atm?



A) A
B) B
C) C
D) D
Answer: D
Diff: 2 Var: 1
Topic: 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.

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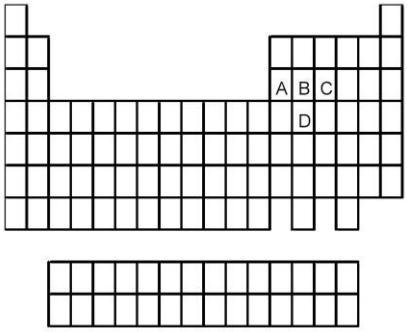
34) Which element indicated by letter in the following periodic table is the poorest conductor of electricity and heat?



A) A
B) B
C) C
D) D
Answer: C
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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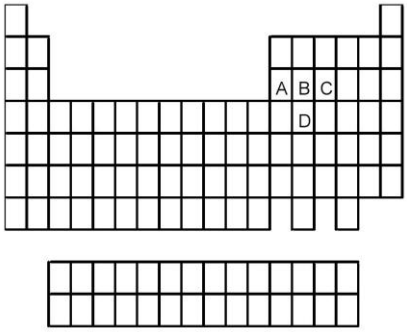
35) Which element indicated by letter in the following periodic table is the best conductor of electricity and heat?



A) A
B) B
C) C
D) D
Answer: A
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

Use the periodic table below to answer the following questions.

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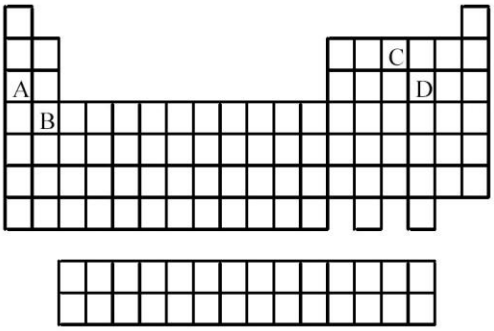

36) Which elements commonly form anions?
A) A and B
B) A and C
C) B and D
D) C and D
Answer: D
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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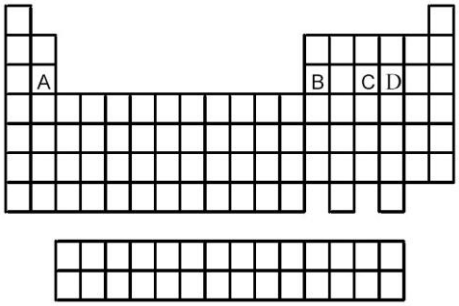
37) Which elements commonly form cations?
A) A and B
B) A and C
C) B and D
D) C and D
Answer: A
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

38) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

Use the periodic table below to answer the following questions.



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39) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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40) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

41) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

42) In which pair are both formulas of binary fluorides of element D correct?
A) DF_2 and DF_3
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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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

43) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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44) 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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

45) Which is most likely to form a binary oxide with the formula M_2O_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: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

46) Which is most likely to form a binary oxide with the formula M_4O_{10} (where M = element A, B, C, or D)?
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A) element A
B) element B
C) element C
D) element D
Answer: C
Diff: 2 Var: 1
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

47) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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48) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

49) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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50) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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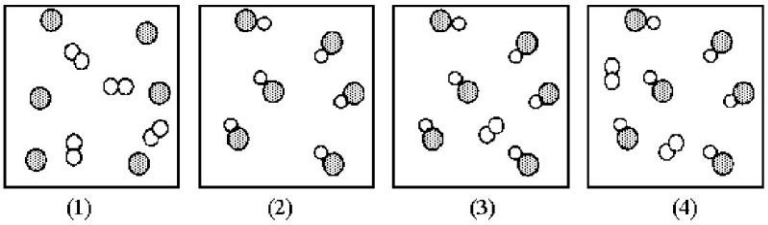
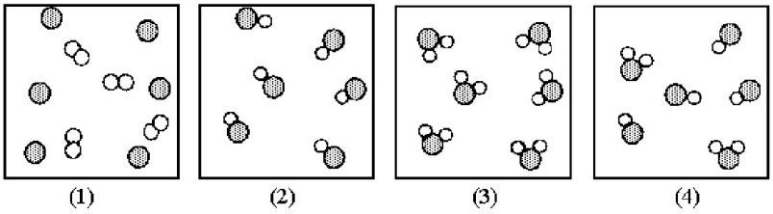
51) Assume that the mixture of substances in drawing (1) undergoes a chemical reaction. Which of the drawings (2)-(4) represents a product mixture that is consistent with the law of mass conservation?



A) drawing (2)
B) drawing (3)
C) drawing (4)
Answer: B
Diff: 2 Var: 1
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

52) 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: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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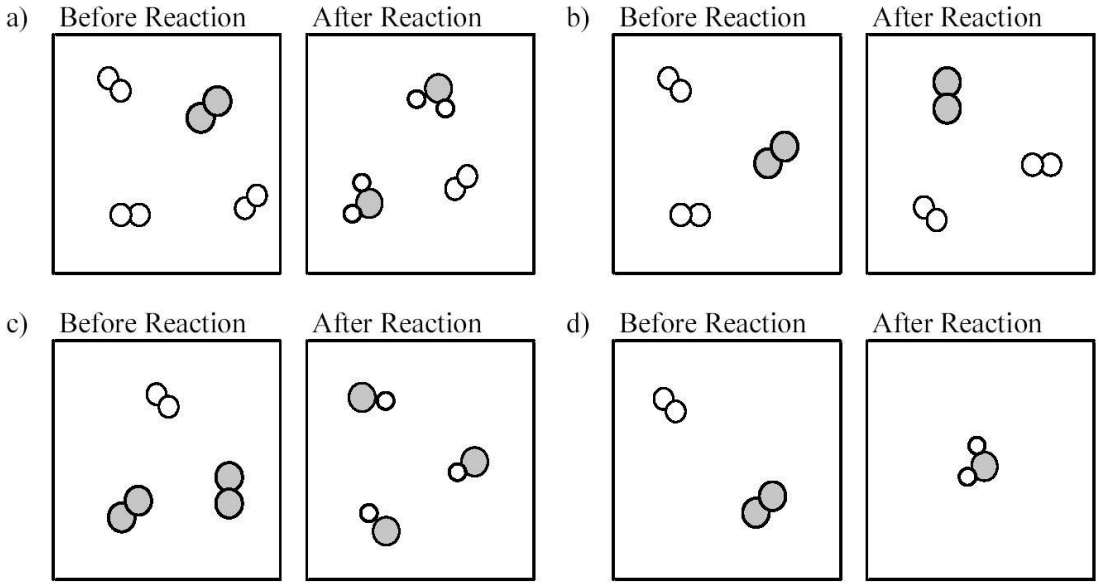
53) Which of the following drawings depicts a chemical reaction consistent with Dalton's atomic theory?



A) drawing a)
B) drawing b)
C) drawing c)
D) drawing d)
Answer: A
Diff: 2 Var: 1
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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54) 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.

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55) 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.

56) 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.

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57) 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.

58) 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.

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59) 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.

60) Elements A and Q form two compounds, AQ and A_2Q_3. The mass ratio (mass Q)/(mass A) for AQ is 0.574. What is the mass ratio (mass Q)/(mass A) for A_2Q_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.

61) Elements A and Q form two compounds, AQ and A_2Q. Which of the following must be true?
A) (mass Q)/(mass A) is one for AQ, and 1/2 for A_2Q.
B) (mass Q)/(mass A) for AQ must equal (mass Q)/(mass A) for A_2Q.
C) (mass Q)/(mass A) for AQ must be 2 times (mass Q)/(mass A) for A_2Q.
D) (mass Q)/(mass A) for AQ must be 1/2 (mass Q)/(mass A) for A_2Q.
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.

62) Elements A and Q form two compounds. The ratio (mass Q)/(mass A) for compound one is 0.271 and ratio (mass Q)/(mass A) for compound two is 0.362. If compound one has the chemical formula AQ, what is the chemical formula for compound two?
A) A_3Q_4
B) A_2Q_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.

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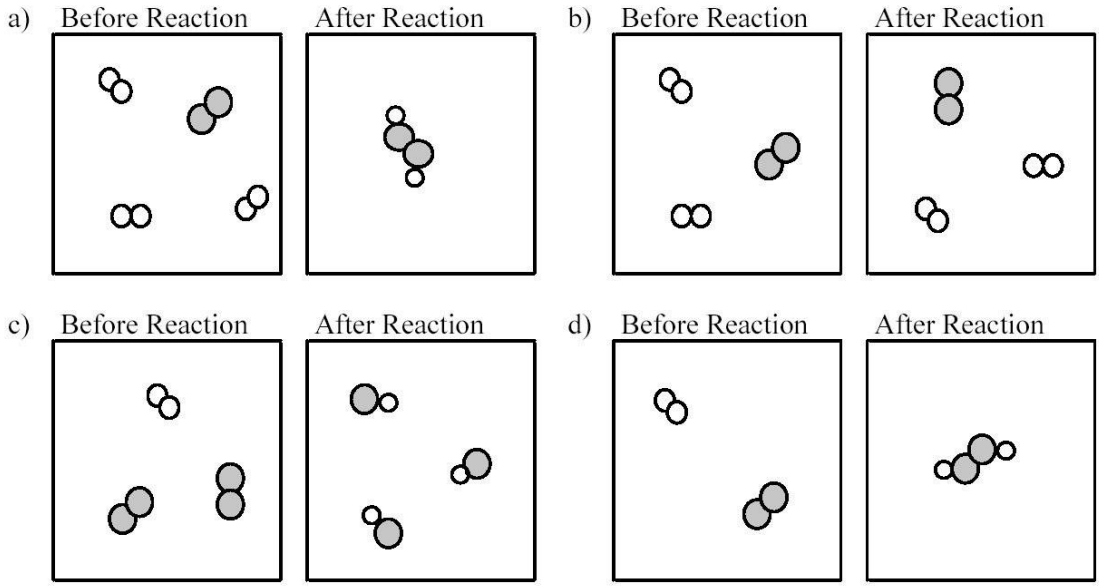
63) Which of the following drawings depicts a chemical reaction consistent with Dalton's atomic theory?



A) drawing a)
B) drawing b)
C) drawing c)
D) drawing d)
Answer: D
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Diff: 2 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: G3 Read and interpret graphs and data.

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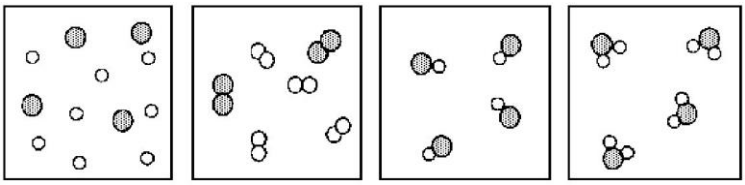
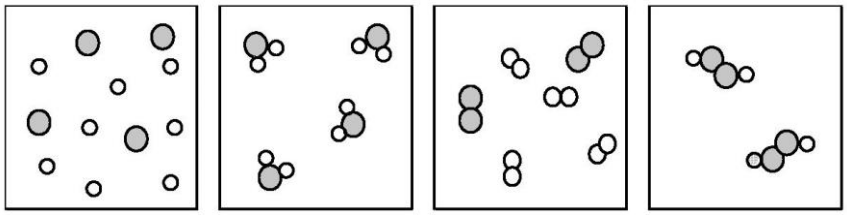
64) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?



(1) (2) (3) (4)

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: 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: G3 Read and interpret graphs and data.

65) 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?



(1) (2) (3) (4)

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: 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: G3 Read and interpret graphs and data.

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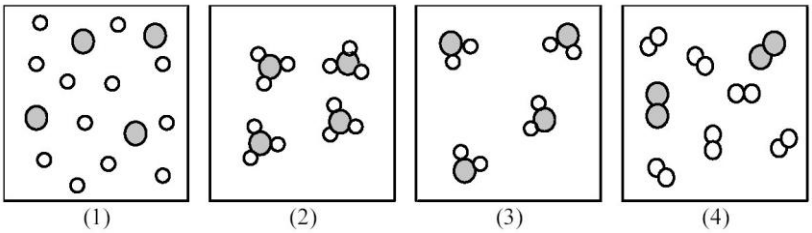
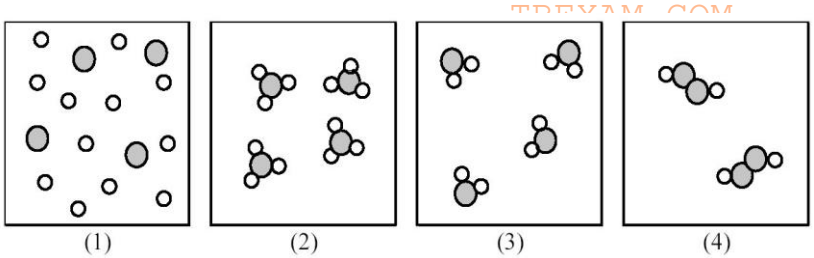
66) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which drawings (2)-(4) represent the law of multiple proportions?



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: 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: G3 Read and interpret graphs and data.

67) 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: 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: G3 Read and interpret graphs and data.

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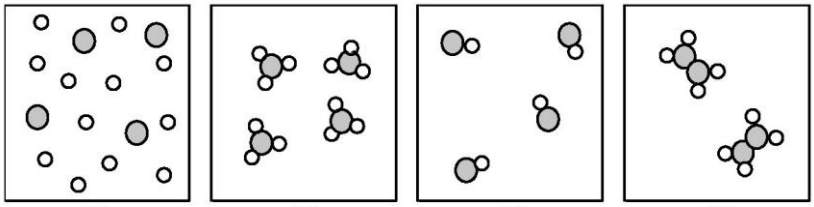
68) If shaded and unshaded spheres represent atoms of different elements, as shown in drawing (1), which combination of drawings (2)-(4) represent the law of multiple proportions?



(1) (2) (3) (4)

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: 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: G3 Read and interpret graphs and data.

69) 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 2.10a Describe Thomson's cathode-ray experiment and what it contributed to the current model of atomic structure.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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70) 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 2.10a Describe Thomson's cathode-ray experiment and what it contributed to the current model of atomic structure.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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71) 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 2.12 Describe Rutherford's gold foil experiment and what it contributed to the current model of atomic structure.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

72) 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
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

73) Most of the alpha particles directed at a thin gold foil in Rutherford's experiment
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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 2.12 Describe Rutherford's gold foil experiment and what it contributed to the current model of atomic structure.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

74) 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
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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75) 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 2.14 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.

76) 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.

77) Which of the following two atoms are isotopes?
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A) $^{40}_{18}Ar$ and $^{40}_{20}Ca$
B) $^{12}_{6}C$ and $^{13}_{6}C$
C) $^{35}_{17}Cl$ and $^{80}_{35}Br$
D) $^{24}_{12}Mg$ and $^{12}_{6}C$
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.

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78) Which of the following represent isotopes?

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

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 2.14 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.

79) Boron-9 can be represented as
A) $^{9}_{4}$Be.
B) $^{9}_{5}$B.
C) $^{14}_{5}$B.
D) $^{14}_{9}$B.

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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.

80) How many protons (p) and neutrons (n) are in an atom of $^{90}_{38}$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 2.14 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.

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81) 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.

82) 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.

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

84) 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.

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85) How many protons (p), neutrons (n), and electrons (e) are in a neutral atom of iodine-125?
A) 53 p, 72 n, 53 e
B) 53 p, 72 n, 72 e
C) 72 p, 53 n, 53 e
D) 72 p, 53 n, 72 e
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.

86) 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 2.14 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.

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87) 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.

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88) Three atoms have the following properties.

	Proton	Neutron	Electron
Atom X	119	119	119
Atom Y	119	118	119
Atom Z	118	118	119

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.

89) Three atoms have the following properties.

	Proton	Neutron	Electron
Atom X	119	119	119
Atom Y	119	118	119
Atom Z	118	118	119

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

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90) Three atoms have the following properties.

	Proton	Neutron	Electron
Atom X	119	119	119
Atom Y	119	119	118
Atom Z	118	118	119

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
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.

91) 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
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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.

92) The smallest sample of carbon atoms that can be observed with the naked eye has a mass of approximately 2×10^{-8} g. Given that 1 g = 6.02×10^{23} amu, and that carbon has an atomic weight of 12.01 amu, determine the number of carbon atoms present in the sample.
A) 1×10^{15}
B) 1×10^{16}
C) 1×10^{17}
D) 6×10^{23}
Answer: A
Diff: 3 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

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93) 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 2.15 Calculate atomic weight given the fractional abundance and mass of each isotope.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

94) 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 2.15 Calculate atomic weight given the fractional abundance and mass of each isotope.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

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95) Magnesium has three naturally occurring isotopes. One has an isotopic abundance of 78.99% and a mass of 23.985042 amu, and the second one has an isotopic abundance of 10.00% and a mass of 24.985837 amu. What is the mass of the third isotope?
A) 24.942510 amu
B) 25.982593 amu
C) 26.034213 amu
D) 26.954385 amu
Answer: B
Diff: 3 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.15 Calculate atomic weight given the fractional abundance and mass of each isotope.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

96) What is the mass of one atom of the element hydrogen?
A) 2.0 g
B) 1.0 g
C) 3.4×10^{-24} g
D) 1.7×10^{-24} g
Answer: D
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

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97) A student weighs out 14.9 mg of vanadium. How many moles are in the sample?

A) 2.92×10^{-4} moles

B) 2.92×10^{-1} moles

C) 1.49×10^{-4} moles

D) 1.49×10^{-1} moles

Answer: A

Diff: 2 Var: 1

Topic: Section 2.9 Atomic Weights and the Mole

Learning Obj: LO 2.16 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.

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

A) 0.533 mol, 8.85×10^{-25} atoms

B) 0.533 mol, 3.21×10^{23} atoms

C) 1.87 mol, 3.10×10^{-24} atoms

D) 1.87 mol, 1.13×10^{24} atoms

Answer: B

Diff: 2 Var: 1

Topic: Section 2.9 Atomic Weights and the Mole

Learning Obj: LO 2.16 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.

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99) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds

Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.

Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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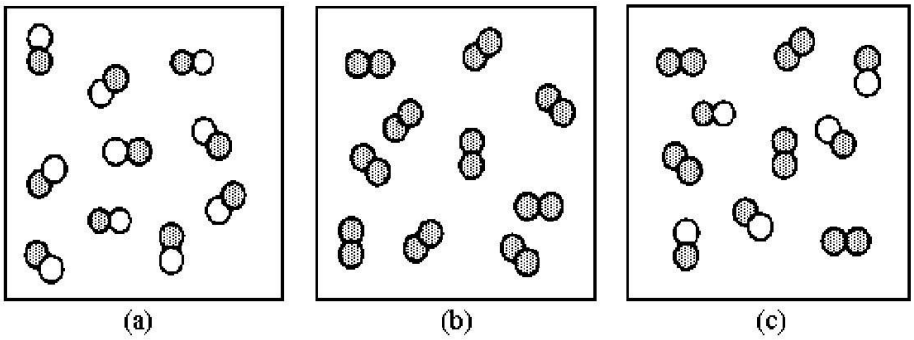

100) Which of the above drawings represents a pure element?
A) drawing (a)
B) drawing (b)
C) drawing (c)
Answer: B
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

101) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

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102) Which of the above drawings represents a mixture?
A) drawing (a)
B) drawing (b)
C) drawing (c)
Answer: C
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

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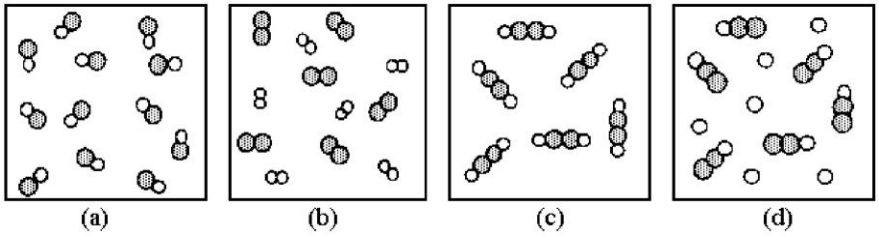
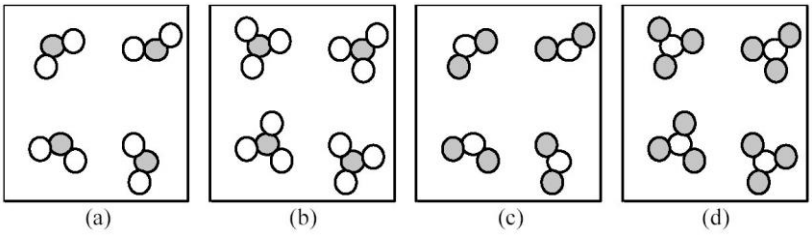
103) Which of the following drawings represents a collection of acetylene (C_2H_2) molecules? The shaded spheres represent carbon atoms and the unshaded spheres represent hydrogen atoms.



A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: C
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

104) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G3 Read and interpret graphs and data.

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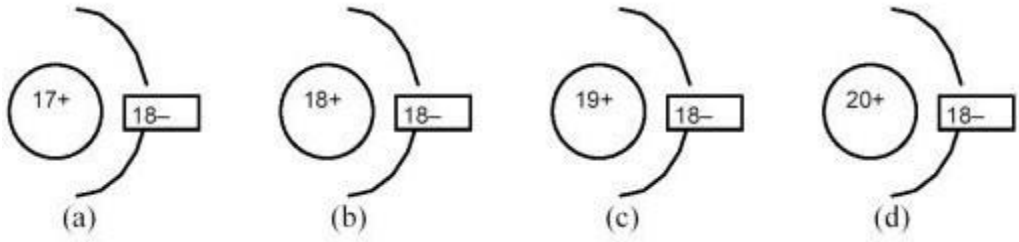

105) Which of the above drawings represents an Ar atom?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

106) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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107) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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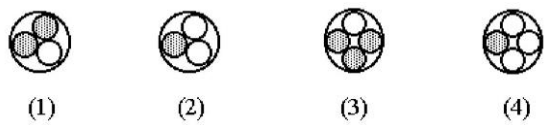
108) Which of the above drawings represents a K^+ ion?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: C
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

109) 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
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Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
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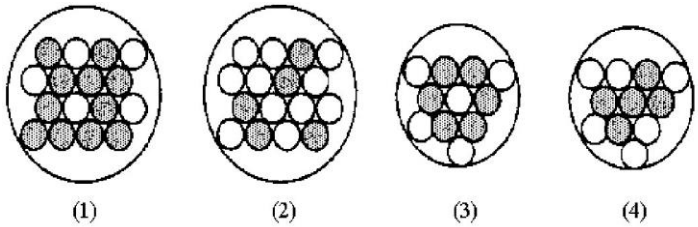
110) Which of the following figures represents $^{11}_{5}B$? Unshaded spheres represent neutrons and shaded spheres represent protons.



A) figure (1)
B) figure (2)
C) figure (3)
D) figure (4)
Answer: D
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

111) Which of the following figures represents $^{15}_{7}N$? Unshaded spheres represent neutrons and shaded spheres represent protons.

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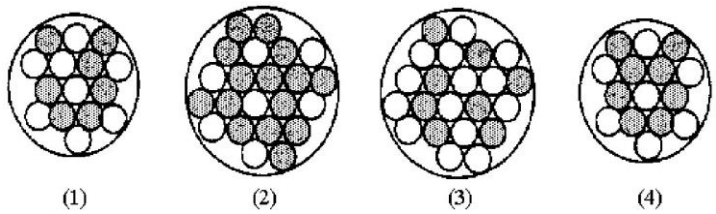

A) figure (1)
B) figure (2)
C) figure (3)
D) figure (4)
Answer: A
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
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Global Obj: G3 Read and interpret graphs and data.

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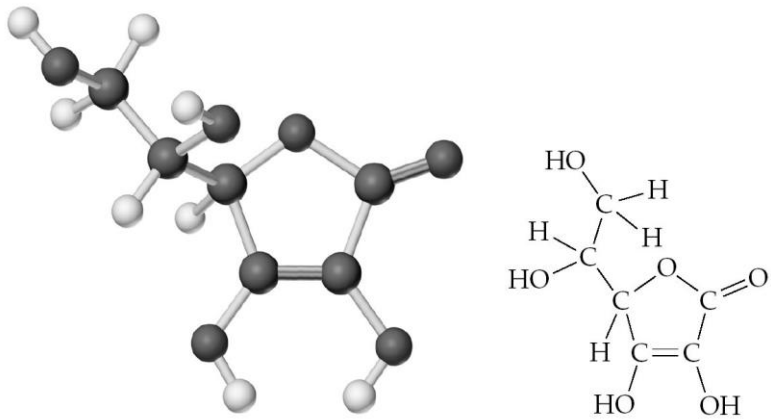
112) Give the molecular formula corresponding to the following ball-and-stick molecular representation of vitamin C (ascorbic acid) (gray = C, unshaded = H, black = O). In writing the formula, list the atoms in alphabetical order.



Vitamin C
(ascorbic acid)

A) CHO
B) $C_3H_4O_3$
C) $C_6H_4O_6$
D) $C_6H_8O_6$
Answer: D

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Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 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.

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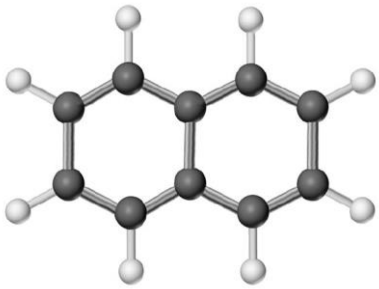
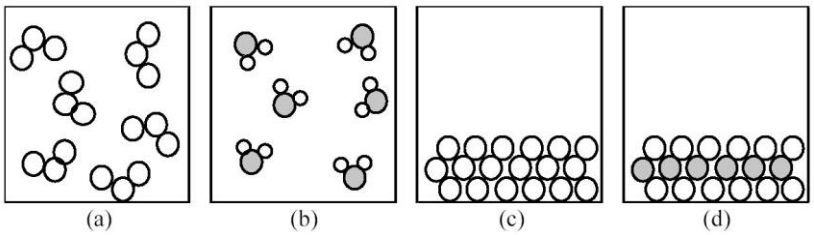
113) Give the molecular formula corresponding to the following ball-and-stick molecular representation of naphthalene (gray = C, unshaded = H). In writing the formula, list the atoms in alphabetical order.



A) CH
B) C_5H_4
C) $C_{10}H_8$
D) $C_{10}H_{10}$
Answer: C
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 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.



114) 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
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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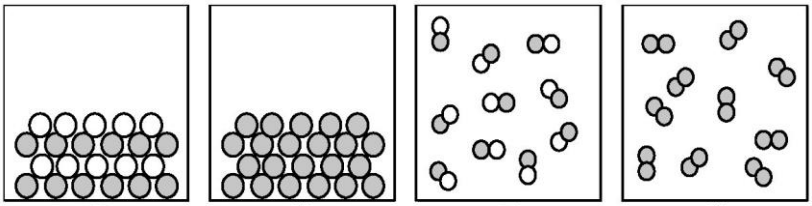
115) If shaded and unshaded spheres represent atoms of different elements, which of the above drawings most likely represents a molecular compound at room temperature and a pressure of 1 atm?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.



116) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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117) 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: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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118) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

119) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

120) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

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121) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

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122) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

123) The solid compound, NH_4NO_3, contains

A) NH_4^+ ions and NO_3^- ions.
B) N^{3-} ions, H^+ ions, and O^{2-} ions.
C) N_2, H_2, and O_2 molecules.
D) NH_4NO_3 molecules.
Answer: A
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

124) The ion NO_3^- is named

A) nitrate ion.
B) nitrite ion.
C) nitrogen dioxide ion.
D) nitrogen(II) oxide ion.
Answer: A
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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125) Which of the species below has 28 protons and 26 electrons?

A) Fe^{2+}
B) Ni^{2+}
C) $^{54}_{26}Fe$
D) $^{54}_{28}Ni$
Answer: B
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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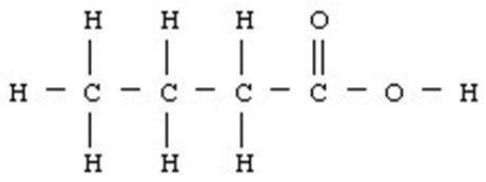
126) Butyric acid has the structural formula given below.



What is the molecular or chemical formula for butyric acid?
A) CHO
B) C_2H_4O
C) $C_4H_8O_2$
D) $C_5H_8O_3$
Answer: C
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

127) The solid compound, Na_2CO_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_2CO_3 molecules.
Answer: B
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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128) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

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129) The gas Freon-11, CCl_3F, contains

A) C^{4+}, Cl^-, and F^- ions.

B) C^{4+}, Cl_3^-, and F^- ions.

C) C^{4+} and Cl_3F^{4-} ions.

D) CCl_3F molecules.

Answer: D
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

130) 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 2.13 Naming Chemical Compounds
Global Obj: G1 Demonstrate an understanding of the principles of scientific inquiry.

131) The formula for dinitrogen trioxide is
A) $N(OH)_3$.

B) $(NO_3)_2$.

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C) N_2O_3.

D) N_3O_2.

Answer: C
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

132) The chemical formula for potassium peroxide is
A) KOH.
B) KO_2.

C) K_2O.

D) K_2O_2.

Answer: D
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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133) By analogy with the oxoanions of sulfur, H_2TeO_3 would be named

A) hydrotellurous acid.
B) pertelluric acid.
C) telluric acid.
D) tellurous acid.
Answer: D
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

134) The ions ClO_4^-, ClO_3^-, ClO_2^-, and ClO^- are named respectively

A) hypochlorate, chlorate, chlorite, perchlorite.
B) hypochlorite, chlorite, chlorate, perchlorate.
C) perchlorate, chlorate, chlorite, hypochlorite.
D) perchlorite, chlorite, chlorate, hypochlorate.
Answer: C
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

135) The compound, NO_2, is named

A) nitrate.
B) nitrite.
C) nitrogen dioxide.
D) nitrogen(IV) oxide.
Answer: C
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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136) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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137) The thiosulfate ion is

A) HS^-.

B) HSO_4^{2-}.

C) SO_5^{2-}.

D) $S_2O_3^{2-}$.

Answer: D
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

138) KH_2PO_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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

139) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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140) How many of the following names are correct?

PCl_5	potassium pentachloride
NaCN	sodium cyanide
KrF_4	krypton tetrafluoride
$Fe(NO_3)_2$	iron (II) nitrate

A) 1
B) 2
C) 3
D) 4
Answer: B
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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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 Write symbols to represent element names.
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 Write symbols to represent element names.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

3) What is the chemical symbol for niobium?
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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 Write symbols to represent element names.
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 Write symbols to represent element names.
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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 Write symbols to represent element names.
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 Write symbols to represent element names.
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 Write symbols to represent element names.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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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 Write symbols to represent element names.
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9) What is the chemical symbol for Silver?
A) S
B) Si
C) Au
D) Ag
Answer: D
Diff: 2 Var: 1
Topic: Section 2.1 Chemistry and the Elements
Learning Obj: LO 2.1 Write symbols to represent element names.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

10) 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 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

11) _____ 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.
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12) _____ 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.
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13) 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 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

14) _____ 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 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

15) 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.
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16) 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.
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17) 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.

18) 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.

19) Which of the following elements has chemical properties similar to oxygen?
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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 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

20) 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 Classify an element as a metal, nonmetal, or semimetal using its properties.
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21) 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 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

22) Which of the following elements is classified as a semimetal?
A) calcium
B) silicon
C) fluorine
D) uranium
Answer: B
Diff: 2 Var: 5
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

23) Which of the following elements is a good conductor of heat and electricity?
A) carbon
B) chlorine
C) neon
D) zinc
Answer: D
Diff: 2 Var: 5
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
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24) Which one of the following elements is a **poor** conductor of heat and electricity?
A) copper
B) phosphorus
C) iron
D) lead
Answer: B
Diff: 2 Var: 5
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its properties.
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25) All of the following elements are nonmetals except
A) beryllium.
B) carbon.
C) hydrogen.
D) oxygen.
Answer: A
Diff: 2 Var: 5
Topic: Section 2.3 Some Common Groups of Elements and Their Properties
Learning Obj: LO 2.6 Classify an element as a metal, nonmetal, or semimetal using its 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 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.

27) 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
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28) 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.
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29) 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.

30) 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.

31) Which of the following elements is classified as a semimetal?
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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.

32) 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.

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33) 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.

34) All of the following elements are nonmetals except
A) copper.
B) nitrogen.
C) krypton.
D) phosphorus.
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.

35) 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
Diff: 2 Var: 5
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

36) 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
Diff: 2 Var: 5
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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37) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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39) 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
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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40) Elements A and Q form two compounds, AQ and A_2Q_3. The mass ratio (mass Q)/(mass A) for AQ is 0. 286 . What is the mass ratio (mass Q)/(mass A) for A_2Q_3?
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.

41) 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 Rutherford's gold foil experiment and what it contributed to the current model of atomic structure.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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42) 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 2.14 Determine the mass number, atomic number, and number of protons, neutrons, and electrons from an isotope symbol.
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43) Which of the following represent isotopes?

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

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 2.14 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.

44) 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
Diff: 2 Var: 5
Topic: Section 2.8 Atomic Numbers
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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) 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
Diff: 2 Var: 5
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.

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46) 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
Diff: 2 Var: 5
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.

47) How many electrons are in a neutral atom of iodine-131?
A) 1
B) 53
C) 54
D) 131
Answer: B
Diff: 2 Var: 5
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) Identify the chemical symbol of element Q in $^{76}_{34}Q$.

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A) As
B) Mo
C) Os
D) Se
Answer: D
Diff: 2 Var: 5
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) 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.

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50) The isotope represented by $^{9}_{6}C$ 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 2.14 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.

51) A bottle of pure element was missing part of a label. The label said 2.258 × 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 2.16 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.

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52) What is the standard isotope that is used to define the number of atoms in a mole?
A) ^{14}N
B) ^{12}C
C) ^{9}Be
D) ^{31}P
Answer: B
Diff: 1 Var: 50+
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

53) The number of atoms of carbon in 28 g of silicon is
A) 28
B) $28 \times 6.022 \times 10^{22}$
C) 2.8×10^{23}
D) 6.022×10^{23}
Answer: D
Diff: 2 Var: 8
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 Convert between grams and numbers of moles or atoms using molar mass and Avogadro's number.
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54) 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 2.16 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.

55) 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 2.16 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.

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56) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

57) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
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58) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

59) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

60) A cake is an example of
A) a compound.
B) an element.
C) mixture.
D) an anion.
Answer: C
Diff: 2 Var: 21
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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61) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
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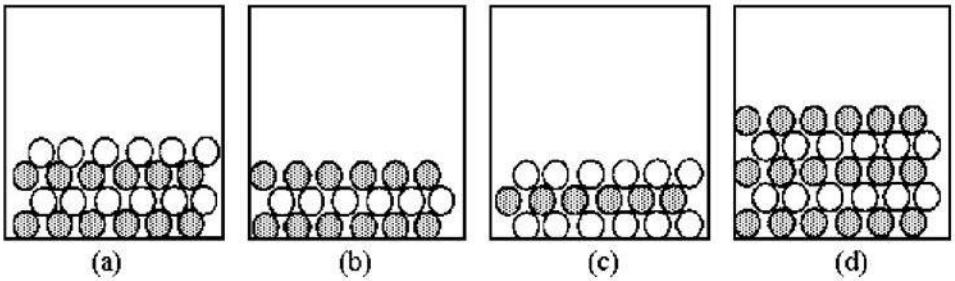
62) Aluminum is an example of
A) a compound.
B) an element.
C) a mixture.
D) an ion.
Answer: B
Diff: 2 Var: 27
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

63) 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 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

In the following drawings, shaded spheres represent cations and unshaded spheres represent anions.



64) 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
Diff: 3 Var: 8
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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65) Which drawing represents the ionic compound Ag_2CO_3?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: B
Diff: 3 Var: 16
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

66) Which drawing represents the ionic compound $Ba\ F_2$?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: C
Diff: 3 Var: 36
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

67) Which drawing represents the ionic compound $Ag\ ClO_3$?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: A
Diff: 3 Var: 21
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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68) Which drawing represents the ionic compound $Rb\ ClO_4$?
A) drawing (a)
B) drawing (b)
C) drawing (c)
D) drawing (d)
Answer: A
Diff: 3 Var: 15
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.19 Convert between structural formulas, ball-and-stick models, and chemical formulas.
Global Obj: G3 Read and interpret graphs and data.

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69) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

70) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

71) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

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72) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
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73) 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^{2-}
C) CO^{3+}, Rh^{3+}, Ir^{3+}
D) Br, Co^{2+}, Co^{3+}
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 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.

74) 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^{2-}
C) Mg^{2+}, Ca^{2+}, Ba^{2+}
D) S, S^{2-}, S^{2+}
Answer: A
Diff: 2 Var: 50+
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

75) In which of the following sets do all species have the same number of protons?
A) Br^-, Kr, Rb^{2+}
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B) C, N^{3-}, O^{2-}
C) Mg^{2+}, Ca^{2+}, Ba^{2+}
D) O, O^{2-}, O^{2+}
Answer: D
Diff: 2 Var: 50+
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

76) 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
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 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.

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77) How many electrons are in the ion, SO_4^{2-}?

A) 26
B) 46
C) 48
D) 50
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

78) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

79) What type of bonding is found in the compound NH_3?

A) covalent bonding
B) hydrogen bonding
C) ionic bonding
D) metallic bonding
Answer: A
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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

A) MgO
B) HCl
C) PCl_3
D) CO_2
Answer: A
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
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81) Which of the following is the correct chemical formula for a molecule of iodine?
A) I
B) I^-
C) I^+
D) I_2
Answer: D
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

82) Which of the compounds, CaH_2, H_2O, CH_4, XeF_4 are ionic compounds?
A) only CH_4
B) only CaH_2
C) CaH_2 and XeF_4
D) H_2O, CH_4, and XeF_4
Answer: B
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

83) Which of the compounds C_2H_6, $CaCl_2$, $Cu(NO_3)_2$, OF_2 are expected to exist as molecules?
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A) only C_2H_6
B) C_2H_6 and OF_2
C) C_2H_6, $Cu(NO_3)_2$, and OF_2
D) $CaCl_2$ and $Cu(NO_3)_2$
Answer: B
Diff: 2 Var: 5
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

84) 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 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
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85) The solid compound, Na_4SiO_4, contains

A) Na^+, Si^{4+}, and O^{2-} ions.

B) Na^+ ions and SiO_4^{4-} ions.

C) Na_4^+ and SiO_4^{4-} ions.

D) Na_4SiO_4 molecules.

Answer: B
Diff: 2 Var: 4
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.22 Match the molecular representation of an ionic compound with its chemical formula.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

86) What is the chemical formula for nickel(II) phosphate?

A) Ni_2P

B) Ni_2PO_4

C) Ni_3P_2

D) $Ni_3(PO_4)_2$

Answer: D
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

87) What is the charge on the Sc ions in Sc_2O_3?

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A) 2-
B) 1+
C) 2+
D) 3+
Answer: D
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

88) Na_2S is named

A) sodium disulfide.
B) sodium sulfide.
C) sodium(II) sulfide.
D) sodium sulfur.
Answer: B
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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89) What is the chemical formula for strontium hydroxide?
A) SrH_2
B) SrOH
C) $SrOH_2$
D) $Sr(OH)_2$
Answer: D
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

90) What is the chemical formula for radium hydride?
A) RaH_2
B) RaOH
C) $RaOH_2$
D) $Ra(OH)_2$
Answer: A
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

91) An aqueous solution of H Cl is named
A) hydrochloric acid.
B) hydrochlorous acid.
C) chloric acid.
D) chlorous acid.
Answer: A
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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92) The chemical formula for the nitrite ion is
A) N^{2-}.
B) N^{3-}.
C) NO_2^-.
D) NO_3^-.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
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93) The chemical formula for rubidium peroxide is
A) RbOH.
B) RbO_2.
C) Rb_2O.
D) Rb_2O_2.
Answer: D
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

94) The compound, $Cu(IO_3)_2$, 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

95) The compound, ClO , is named
A) chlorite.
B) hypochlorite.
C) chlorine monoxide.
D) chlorine (II) oxide.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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96) 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: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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97) The chemical formula for chlorous acid is
A) H ClO(*aq*).
B) H ClO_2(*aq*).
C) H ClO_3(*aq*).
D) H Cl O_4(*aq*).
Answer: B
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

98) The chemical formula for magnesium nitride is
A) $Mg(NO_3)_2$.
B) $Mg(NO_2)_2$.
C) Mg_3N_2.
D) MgN_2.
Answer: C
Diff: 2 Var: 5
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

99) In which set do all elements tend to form cations in binary ionic compounds?
A) Na, B, S
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B) Ca, Cr, Pb
C) S, As, Bi
D) O, Br, I
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

100) 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
Diff: 2 Var: 50+
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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101) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

102) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

103) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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104) Which one of the following compounds contains ionic bonds?
A) Mg S
B) HF
C) NCl_3
D) SiO_2
Answer: A
Diff: 2 Var: 48
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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105) Which of the following is the correct chemical formula for a molecule of nitrogen?
A) N
B) N^-
C) N^+
D) N_2
Answer: D
Diff: 2 Var: 7
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

106) Which of the compounds, Na_3P, PH_3, C_2H_6, IBr_3, are ionic compounds?
A) only C_2H_6
B) only Na_3P
C) Na_3P and PH_3
D) PH_3, C_2H_6, and IBr_3
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

107) Which of the compounds, C_5H_{12}, CaF_2, $Pd(NO_3)_2$, OCl_2, are expected to exist as molecules?
A) only C_5H_{12}
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B) C_5H_{12} and OCl_2
C) C_5H_{12}, $Pd(NO_3)_2$, and OCl_2
D) CaF_2 and $Pd(NO_3)_2$
Answer: B
Diff: 2 Var: 50+
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.24 Convert between name and formula for binary molecular compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

108) 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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109) What is the chemical formula for iron(II) phosphate?
A) Fe_2P
B) Fe_2PO_4
C) Fe_3P_4
D) $Fe_3(PO_4)_2$
Answer: D
Diff: 2 Var: 36
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

110) What is the charge on the In in the ionic compound In_2Te_3?
A) 2-
B) 1+
C) 2+
D) 3+
Answer: D
Diff: 2 Var: 48
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

111) Na_2O is named
A) sodium di oxide.
B) sodium oxide.
C) sodium(II) oxide.
D) sodium oxygen.
Answer: B
Diff: 2 Var: 24
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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112) What is the chemical formula for cesium bicarbonate?
A) Cs_2HCO_3
B) Cs HCO
C) Cs HCO_2
D) Cs HCO_3
Answer: D
Diff: 2 Var: 18
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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113) What is the chemical formula for calcium chromate?
A) Ca CrO_2
B) Ca CrO
C) Ca CrO_3
D) Ca CrO_4
Answer: D
Diff: 2 Var: 27
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

114) The chemical formula for the carbonate ion is
A) C^-.
B) CO^-.
C) CO_3^{2-}.
D) CO_2^{2-}.
Answer: C
Diff: 2 Var: 32
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

115) The compound, $Sn(IO_3)_2$, 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 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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116) The chemical formula for calcium telluride is
A) $Ca(TeO_3)$.
B) $Ca(TeO_2)$.
C) Ca Te.
D) $Ca Te_2$.
Answer: C
Diff: 2 Var: 24
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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117) 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
Diff: 2 Var: 50+
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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 Write symbols to represent element names.
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 Write symbols to represent element names.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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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: 26 Var: 1
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: 26 Var: 1
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 is given.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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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 Classify an element as a metal, nonmetal, or semimetal using its properties.
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 H_2O, then the number of grams of NaBr produced is _____.

$HBr + NaOH \rightarrow H_2O + NaBr$
Answer: 103 g
Diff: 2 Var: 1
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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 CO_2 is _____.
Answer: 6 g
Diff: 2 Var: 1
Topic: Section 2.4 Observations Supporting Atomic Theory: The Conservation of Mass and the Law of Definite Proportions
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.

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11) The charge to mass ratio of an electron was determined from Rutherford's cathode-ray tube experiment to be 1.759×10^{8} 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 2.11 Describe Milikan's oil drop experiment and what it contributed to the current model of atomic structure.
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
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.
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Answer: protons, neutrons
Diff: 1 Var: 1
Topic: Section 2.8 Atomic Numbers
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: $^{226}_{88}\text{Ra}$
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.

16) The symbol for technetium-98 is _____.
Answer: $^{98}_{43}\text{Tc}$
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.
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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 2.15 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
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

21) To the nearest whole number, the number of grams of Ba in 3.25 mol of Ba is _____.
Answer: 446 g
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

22) The number of moles of Li in 34.7 g Li is _____.
Answer: 5.00 mol
Diff: 2 Var: 1
Topic: Section 2.9 Atomic Weights and the Mole
Learning Obj: LO 2.16 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.

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23) 10% saline solution (sodium chloride dissolved in water) is an example of a _____.
Answer: mixture
Diff: 2 Var: 1
Topic: Section 2.11 Mixtures and Chemical Compounds: Molecules and Covalent Bonds
Learning Obj: LO 2.18 Classify matter as a mixture, pure substance, element, or compound.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

24) The number of electrons in the ion Ca^{2+} is _____.
Answer: 18
Diff: 2 Var: 1
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

25) The number of electrons in the ion C^{4-} is _____.
Answer: 10
Diff: 2 Var: 1
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.21 Determine the number of electrons and protons from chemical symbol and charge.
Global Obj: G4 Demonstrate the quantitative skills needed to succeed in chemistry.

26) The bonding in NaI is _____, whereas the bonding in NH_3 is _____.
Answer: ionic, covalent
Diff: 2 Var: 1
Topic: Section 2.12 Ions and Ionic Bonds
Learning Obj: LO 2.20a Classify bonds as ionic or covalent.
Global Obj: G2 Demonstrate the ability to think critically and employ critical thinking skills.

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27) Phosphate ion has the formula _____.
Answer: PO_4^{3-}
Diff: 2 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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: 26 Var: 1
Topic: Section 2.13 Naming Chemical Compounds
Learning Obj: LO 2.23 Convert between name and formula for ionic compounds.
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