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Chemistry for Changing Times, 14e **(Hill/McCreary)**
Chapter 2 Atoms

2.1 Multiple Choice Questions

1) The Greek word **atomos** means
A) atom.
B) uncuttable.
C) invisible.
D) continuous.
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

2) Leucippus and Democritus proposed the "first" atomic view of matter. They arrived at this view based on
A) many experiments.
B) careful measurements.
C) philosophical and intuitive speculation.
D) All of the above contributed to their atomic view.
Answer: C
Diff: 3 Var: 1 Page Ref: Sec. 2.1
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Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

3) The ancient Greeks believed that matter was composed of four basic elements. Which one of the following was **NOT** one of the four?
A) mercury
B) air
C) water
D) earth
Answer: A
Diff: 2 Var: 8 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

4) How many years ago was an atomic **view** of matter was first proposed?
A) 50
B) 100
C) 200
D) 2500
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

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5) Which philosopher believed that matter was continuous and was not made up of atoms?
A) Aristotle
B) Dalton
C) Democritus
D) Lavoisier
Answer: A
Diff: 1 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

6) Leucippus and Democritus believed that all of the following statements about matter were true **EXCEPT**
A) Matter was made up of atoms.
B) Each type of matter had a distinctive size and shape.
C) Matter was continuous.
D) Substances are mixtures of different kinds of atoms.
Answer: C
Diff: 3 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

7) Which of the following statements about atoms is **NOT** true?
A) Atoms are too small to be seen even with a microscope.
B) Atoms make up every material.
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C) Atoms are the smallest particles that are characteristic of a given element.
D) No atoms have been synthesized by scientists.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

8) Approximately how many elements occur naturally on Earth?
A) 20
B) 60
C) 90
D) 115
Answer: C
Diff: 1 Var: 27 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

9) The "father of modern chemistry" is
A) Boyle.
B) Lavoisier.
C) Mendeleev.
D) Proust.
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

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10) 32 g of sulfur will react with 48 g of oxygen to produce 80 g of sulfur trioxide. If 16 g of sulfur and 100 g of oxygen are placed into a sealed container and allowed to react, what is the mass of the material in the container after the reaction is completed?
A) 40 g
B) 16 g
C) 100 g
D) 116 g
Answer: D
Diff: 2 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

11) 32 g of sulfur will react with 48 g of oxygen to produce 80 g of sulfur trioxide. If 16 g of sulfur and 100 g of oxygen are placed into a sealed container and allowed to react, what is the mass of sulfur trioxide in the container after the reaction is completed?
A) 40 g
B) 16 g
C) 100 g
D) 116 g
Answer: A
Diff: 2 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

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12) By definition, which of the following can be broken down into simpler substances?
A) compound
B) atom | ion
C) solid
D) liquid
Answer: A
Diff: 1 Var: 6 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

13) Lavoisier performed many of the same experiments as his predecessors. The one thing that most distinguished Lavoisier's work was
A) the results.
B) the mass measurements.
C) the chemicals.
D) the glassware.
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

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14) Lavoisier measured the mass of substances before and after chemical reactions and summarized his observations in a(n)
A) hypothesis.
B) observation.
C) theory.
D) law.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

15) Which one of the following statements is **NOT** a correct statement of the Law of Conservation of Mass?
A) The mass of a system is dependent upon chemical reactions that may occur.
B) The mass of a system is conserved in a chemical reaction.
C) Matter cannot be created or destroyed.
D) Atoms are conserved in chemical reactions.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

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16) A mixture containing 50 grams of carbon and 75 grams of oxygen is sealed in a flask. The total mass of the system is 225 grams. The flask is heated to cause the carbon and oxygen to react. The sealed flask is massed. What is the mass of the sealed flask?
A) 125 grams
B) 150 grams
C) 175 grams
D) 225 grams
Answer: D
Diff: 3 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

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17) A student measures 10.5 g of mercury(II) oxide into an open test tube and heats the tube. The heat causes the mercury(II) oxide to decompose into mercury and oxygen. After reaction, the student finds the mass of the contents of the tube to be 9.7 g. Which one of the following describes these observations?
A) The decomposition of mercury(II) oxide does not obey the Law of Conservation of Mass.
B) 0.8 grams of oxygen gas are lost from the tube.
C) There are errors associated with the student's measurements.
D) Heating destroys some mass.
Answer: B
Diff: 3 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

18) The amount of carbon on the earth, including the atmosphere,
A) is essentially constant.
B) is decreasing due to consumption of carbon based fuels, such as coal and petroleum.
C) is increasing due to plant and animal growth on the planet.
D) fluctuates dramatically with the seasons.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry and Global 5: Demonstrate an understanding of the impact of science on society.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

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19) The amount of aluminum on the earth today relative to the amount 100 years ago when Al was first commercially extracted from bauxite, an aluminum containing ore,
A) is essentially the same.
B) is decreasing rapidly due to production of aluminum beverage containers.
C) is decreasing, but more slowly recently due to interest in recycling.
D) is actually increasing due to recycling efforts and more energy efficient production methods.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry and Global 5: Demonstrate an understanding of the impact of science on society.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

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20) Hydrogen peroxide decomposes into water and oxygen when exposed to heat or light. A tightly capped bottle of hydrogen peroxide is placed on a mass scale (a balance) and exposed to light for three weeks. The mass reading on the scale does not change. This is an example of
A) the Law of Conservation of Mass.
B) the Law of Definite Proportions.
C) the Law of Constant Composition.
D) the Law of Multiple Proportions.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

21) Methane can be decomposed into two simpler substances, hydrogen and carbon. Therefore, methane
A) is a solid.
B) cannot be an element.
C) must be a mixture.
D) must have the formula CH_2.
Answer: B
Diff: 2 Var: 3 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.

22) The ability to recycle aluminum (or glass, or plastic) is ultimately an illustration of
A) the Law of the Conservation of Mass.
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B) the Law of Definite Proportions.
C) the ingenuity of chemists.
D) the Law of Multiple Proportions.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

23) When electricity is passed through molten potassium bromide, two simpler substances, potassium and bromine, are produced. Therefore, potassium bromide
A) cannot be an element.
B) must be a mixture.
C) has less mass than the resulting potassium and bromine do.
D) must have the formula PB.
Answer: A
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.

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24) The Law of Definite Proportions was first stated by
A) Lavoisier.
B) Galileo.
C) Dalton.
D) Proust.
Answer: D
Diff: 1 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

25) When added to a sealed flask and heated, 6.0 g of carbon and 16.0 g of oxygen react to form 22.0 g of carbon dioxide. How much carbon dioxide is formed when 24.0 g of carbon is reacted with 100.0 g of oxygen?
A) 40.0 g
B) 44.0 g
C) 88.0 g
D) 112.0 g
Answer: C
Diff: 3 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

26) The observation that 10 g of hydrogen gas always combines with 80 g of oxygen gas to form 90 g of water, even when there is more than 80 g of oxygen present in the reaction container, illustrates the Law of
A) Definite Proportions.
B) Multiple Proportions.
C) ideal gases.
D) excess reactants.
Answer: A
Diff: 2 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

27) No matter how much extra oxygen is available, 12 grams of carbon always combines with 32 grams of oxygen. This best illustrates the Law of
A) Conservation of Mass.
B) Definite Proportions.
C) Multiple Proportions.
D) Conservation of Energy.
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

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28) Heptane is always composed of 84.0% carbon and 16.0% hydrogen. This illustrates the Law of
A) Conservation of Mass.
B) Definite Proportions.
C) Multiple Proportions.
D) all of the above
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

29) When 10.00 g of lead and 1.56 grams of sulfur react, 11.56 g of lead sulfide is produced. Suppose 30.00 g of lead and 1.56 g of sulfur are allowed to react. Analysis of the reaction mixture would show
A) 31.56 g of lead sulfide.
B) 34.68 g of lead sulfide.
C) 11.56 g of lead sulfide and 20.00 g of lead.
D) no reaction.
Answer: C
Diff: 4 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

30) 2 g of sulfur will react with 3 g of oxygen to produce 5 g of sulfur trioxide. If 54 g of sulfur and 100 g of oxygen are placed into a sealed container and allowed to react, how much sulfur dioxide will be produced?
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A) 54 g
B) 81 g
C) 135 g
D) 154 g
Answer: C
Diff: 3 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

31) Sample A contains 92.3%carbon and 7.7% hydrogen. If sample B is the same substance, it will contain
A) 80% carbon and 20% hydrogen.
B) 92.3% carbon and 7.7% hydrogen.
C) 83.3% carbon and 16.7% hydrogen.
D) 85% carbon and 15% hydrogen.
Answer: B
Diff: 2 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

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32) CO_2 always contains 3 g of C for every 8 g of O. This is an example of
A) Dalton's Atomic Theory.
B) Lavoisier's Law of Conservation of Mass.
C) Dalton's Law of Multiple Proportions.
D) Proust's Law of Definite Proportions.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

33) When 28 g of nitrogen and 6 g of hydrogen react, 34 g of ammonia are produced. If 80 g of nitrogen react with 4 g of hydrogen, how much ammonia will be produced?
A) 22.6 g
B) 43 g
C) 50 g
D) 4 g
Answer: A
Diff: 3 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

34) Which of the following can be broken down into simpler substances?
A) CO
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B) Se
C) Mg
D) F
Answer: A
Diff: 2 Var: 50+ Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.

35) Which of the following parts (postulates) of Dalton's atomic theory has been modified in light of later discoveries?
A) All matter is made up of very small particles called atoms.
B) Atoms are indivisible.
C) Chemical reactions involve rearrangement of atoms.
D) Compounds are formed from atoms.
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

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36) Which of the following laws is **NOT** explained by Dalton's atomic theory?
A) the Law of Conservation of Mass
B) the Law of Definite Proportions
C) the Law of Multiple Proportions
D) the periodic law
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

37) _____ was the first person to propose a consistent "modern" atomic theory.
A) Dalton
B) Democritus
C) Proust
D) Lavoisier
Answer: A
Diff: 1 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

38) Which discovery was **NOT** in conflict with Dalton's atomic theory?
A) the discovery of electrical charge
B) the discovery of the electron
C) the discovery of the element gallium
D) the discovery of the proton
Answer: C
Diff: 4 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

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39) Which of the following was **NOT** explained by Dalton's atomic theory?
A) the Law of Conservation of Mass
B) the Law of Multiple Proportions
C) the difference between isotopes of an element
D) the difference between elements and compounds
Answer: C
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

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40) After many observations, Proust stated that elements combine in definite proportions to form compounds. Dalton explained these observations by proposing that matter must consist of atoms. Dalton's explanation is called a(n)
A) law.
B) theory.
C) hypothesis.
D) observation.
Answer: B
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

41) Nitrogen forms a number of different compounds with oxygen, depending upon the experimental conditions. This type of observation concerning the behavior of matter is summarized by
A) the Law of Conservation of Mass.
B) the Law of Definite Proportions.
C) the Law of Constant Composition.
D) the Law of Multiple Proportions.
Answer: D
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

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42) Which one of the following is **NOT** part of Dalton's atomic theory?
A) Matter is composed of atoms.
B) Atoms of the same element have the same properties.
C) Atoms of different elements have different properties.
D) Atoms change into other atoms in chemical reactions.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

43) Although all parts (postulates) of Dalton's atomic theory are important, which one of the postulates is crucial to explain the observations summarized by the Law of Definite Proportions?
A) Matter is composed of atoms.
B) Atoms of the same element have the same properties.
C) Atoms combine with other atoms in fixed, whole number ratios to form compounds.
D) Atoms are very small.
Answer: C
Diff: 4 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

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44) Which one of the following does **NOT** occur in a chemical reaction?
A) Matter is rearranged.
B) Matter is conserved.
C) Atoms react with other atoms.
D) Atoms are changed into other atoms.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

45) Dalton explained the Law of Conservation of Mass by stating that atoms are neither created nor destroyed in a chemical reaction. Dalton's explanation is an example of a scientific
A) theory.
B) law.
C) hypothesis.
D) experiment.
Answer: A
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

46) Which set of compounds illustrates the Law of Multiple Proportions?
A) NH_3, PH_3, AsH_3
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B) CH_3, CF_3, CCl_3
C) NH_3, N_2H_4
D) all of these
Answer: C
Diff: 3 Var: 4 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

47) Which set of compounds illustrates the Law of Multiple Proportions?
A) CH_4, C_2H_6, C_3H_8
B) NO, NH_3, NH_4Cl
C) H_2O, H_2
D) all of these
Answer: A
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
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48) Under conditions of limited oxygen, carbon burns to form carbon monoxide, a poisonous gas. In conditions with unlimited oxygen, carbon burns to form carbon dioxide. This illustrates the Law of
A) Conservation of Mass.
B) Definite Proportions.
C) different chemical reactions.
D) Multiple Proportions.
Answer: D
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

49) In plentiful air, 3.0 parts of carbon react with 8.0 parts of oxygen to form carbon dioxide. How much carbon is required to react with 1100 g of oxygen?
A) 600 g
B) 550 g
C) 2930g
D) 413 g
Answer: D
Diff: 5 Var: 5 Page Ref: Sec. 2.3
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

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50) Which set of compounds illustrates the Law of **Multiple Proportions**?
A) SO_2, SO_3
B) N_2O, NO, NO_2
C) H_2O, H_2O_2
D) all of these
Answer: D
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

51) John Dalton discovered which of the following laws?
A) The Law of Conservation of Mass
B) The Law of Definite Proportions
C) The Law of Constant Composition
D) The Law of Multiple Proportions
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

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52) Atoms of the same element that have different masses are called
A) allotropes.
B) anions.
C) isotopes.
D) molecules.
Answer: C
Diff: 2 Var: 8 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

53) Which of the following postulates of Dalton's atomic theory has been modified in light of later discoveries?
A) All matter is made up of very small particles called atoms.
B) All atoms of an element are identical.
C) Chemical reactions involve rearrangement of atoms.
D) Compounds are formed from atoms.
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

54) How many grams of carbon are in 20.0 grams of CH_4?
A) 18.46 grams
B) 14.98 grams
C) 4.00 grams
D) 8.00 grams
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.4
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.7 Convert between the masses and the moles of a substance.

55) One mole is of carbon is equal to
A) 6.022×10^{23} atoms of carbons.
B) 12.011 grams of carbon.
C) Avogadro's number of atoms.
D) all of the above.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.4
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.6 Describe what a mole is and how it is used.

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56) The atomic masses for elements are
A) actual masses determined by weighing individual atoms.
B) relative masses determined by comparison with a standard reference.
C) the same as the atomic number.
D) unknown.
Answer: B
Diff: 2 Var: 1 Page Ref: Sec. 2.4
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

57) Perhaps the greatest triumph of Mendeleev's periodic table was
A) the use of rows and columns to organize the elements.
B) the ability to predict electron configurations of elements.
C) the use of atomic numbers as an organizing criterion.
D) the prediction of the existence of undiscovered elements.
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

58) The scientist who in 1828 published a table of atomic weights containing 54 elements was
A) Dalton.
B) Berzelius.
C) Mendeleev.
D) Boyle.
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

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59) The Periodic Table is helpful in all of the following endeavors but one. Which is the exception?
A) predicting formulas of compounds
B) predicting chemical reactivity of elements
C) predicting physical properties of elements
D) predicting monetary values of elements
Answer: D
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

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60) Mendeleev arranged elements in the periodic table primarily in order of their
A) atomic masses.
B) atomic weights.
C) both atomic weights and atomic numbers.
D) number of neutrons.
Answer: A
Diff: 1 Var: 9 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

61) What is the name of the Russian chemist who was a pioneer in the development of the periodic law?
A) Meyerovic
B) Mendeleev
C) Döbereiner
D) Berzelius
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

62) When Mendeleev developed his periodic table, he placed the **greatest** emphasis on
A) the atomic number of the elements.
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B) putting elements with similar properties in the same column.
C) leaving no holes or blank spaces in the table.
D) the melting points of the elements.
Answer: B
Diff: 2 Var: 6 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

63) The "box" for an element on the periodic table will include all of the following information about an element **EXCEPT**
A) its atomic number.
B) the proportion of the element in a compound.
C) its atomic symbol.
D) its atomic mass.
Answer: B
Diff: 1 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

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64) Mendeleev's periodic table organized elements in a systematic way. Which of the following attempted to arrange elements in a systematic way and can be considered a "precursor" of the modern periodic table?
A) Dalton's Atomic Theory
B) Dalton's Atomic Masses
C) Döbereiner's Triads
D) Berzelius's Atomic Weights
Answer: C
Diff: 3 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

65) In 1961, the reference for the atomic mass unit (amu or u) was changed from naturally occurring oxygen with a value of 16.000 u to one based on a single isotope of carbon (carbon-12). Why was it changed?
A) The atomic composition of oxygen varies depending upon its source.
B) Carbon-12 is more common than oxygen.
C) Carbon exists as only one isotope, carbon-12.
D) Carbon can combine with four atoms of hydrogen to form CH_4, methane, while oxygen only combines with two atoms of hydrogen to form water, H_2O.
Answer: A
Diff: 3 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

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66) Assume that you have a new "triad" of elements (A, B and C) with similar properties. A is the smallest element and has a mass of 30 u. C is the largest element and has a mass of 90 u. The mass of B would be approximately _____ u.
A) 40
B) 45
C) 60
D) 80
Answer: C
Diff: 3 Var: 5 Page Ref: Sec. 2.5
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

67) Is it always possible to recycle and reuse materials?
A) Yes, because atoms cannot be destroyed in a chemical reaction.
B) Yes, because atoms can only be rearranged in a chemical reaction.
C) No, because atoms can be changed into other kinds of atoms.
D) No, if it is financially impractible to do it.
Answer: D
Diff: 3 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.

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68) For which of the following would recycling of iron **NOT** be practical?
A) old cars that are compressed in junkyards
B) steel beams that have been removed from a bridge
C) rust that flakes off a car body
D) wrought iron fences
Answer: C
Diff: 2 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.

69) If drops of water are subdivided to the ultimately smallest drops possible, what is the smallest particle of water that retains the chemical and physical properties of water?
A) molecule
B) mixture
C) atom
D) micron
Answer: A
Diff: 1 Var: 6 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.9 Distinguish atoms from molecules.

70) All of the following are molecules **EXCEPT _____.**
A) H_2
B) NO
C) H
D) O_3
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Answer: C
Diff: 3 Var: 24 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.9 Distinguish atoms from molecules.

71) All of the following are examples of molecules **EXCEPT _____.**
A) Si
B) CO
C) I_2
D) NO_2
Answer: A
Diff: 3 Var: 50+ Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.9 Distinguish atoms from molecules.

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72) Which of the following changes is **NOT** an example of green chemistry?
A) replacing mercury thermometers with alcohol thermometers
B) using large amounts of solvents such as benzene, which is a carcinogen
C) replacing energy from coal-fired power plants with energy from alternative sources
D) replacing lead in paint with titanium dioxide
Answer: B
Diff: 3 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.11 Explain how green chemistry can change technologists that rely on hazardous or rare elements.

73) Which of the following is an example of green chemistry?
A) building new coal-fired plants to generate electricity
B) developing new technologies that require rare elements
C) using materials that are made up of substances that are very abundant in the earth's crust
D) using lead as a plasticizer to make plastics less rigid
Answer: C
Diff: 3 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 5: Demonstrate an understanding of the impact of science on society.
Learning Obj: LO 2.11 Explain how green chemistry can change technologists that rely on hazardous or rare elements.

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2.2 True/False Questions

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1) Leucippus and Democritus based their ideas about atoms on careful experimental results.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

2) Aristotle's idea that matter is continuous is still considered to be correct.
Answer: FALSE
Diff: 1 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

3) Democritus thought that real substances were mixtures of various types of atoms.
Answer: TRUE
Diff: 2 Var: 1 Page Ref: Sec. 2.1
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.1 Explain the ancient Greeks' ideas about the characteristics of matter.

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4) During a chemical reaction, matter can neither be created nor destroyed.
Answer: TRUE
Diff: 1 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

5) Lavoisier's experiments showed that matter can be gained or lost in a chemical change.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

6) The Law of Constant Composition and the Law of Definite Proportions are different names for the same phenomenon.
Answer: TRUE
Diff: 1 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

7) Substance A contains 80% carbon and 20% hydrogen. Substance B contains 83% carbon and 17% hydrogen. A and B are the same substance.
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Answer: FALSE
Diff: 2 Var: 25 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

8) Substance A contains 85% carbon and 15% hydrogen. Substance B contains 85 % carbon and 15% hydrogen. A and B are the same substance.
Answer: TRUE
Diff: 2 Var: 5 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

9) Water and hydrogen peroxide are compounds composed of only hydrogen and oxygen. These compounds illustrate the Law of Multiple Proportions.
Answer: TRUE
Diff: 2 Var: 3 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.5 Know how atomic theory explains the laws of multiple proportions and conservation of mass.

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10) Dalton's atomic theory states that atoms may change into other atoms in a chemical reaction.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

11) According to Dalton's Atomic Theory, atoms of the same element may have different masses.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

12) Mendeleev was the first person to attempt to arrange the elements in a systematic order.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

13) Mendeleev arranged the elements in his periodic table solely in order of increasing atomic mass.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

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14) Döbereiner's Triads and Mendeleev's Periodic Table were both based on the idea that properties of elements tended to repeat.
Answer: TRUE
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

15) Germanium was discovered in 1886. Its existence had been predicted by Mendeleev.
Answer: TRUE
Diff: 2 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

16) Scientists can observe computer enhanced images of atoms.
Answer: TRUE
Diff: 2 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.

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17) A molecule is a group of atoms that are chemically bonded together.
Answer: TRUE
Diff: 2 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.9 Distinguish atoms from molecules.

18) We cannot destroy atoms. Thus, it is possible to reclaim and recycle all materials.
Answer: FALSE
Diff: 3 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills.
Learning Obj: LO 2.9 Distinguish atoms from molecules.

19) Recycling of hazardous materials is important.
Answer: TRUE
Diff: 2 Var: 3 Page Ref: Sec. 2.6
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 5: Demonstrate an understanding of the impact of science on society.
Learning Obj: LO 2.11 Explain how green chemistry can change technologists that rely on hazardous or rare elements.

20) There is no difference between the hazard posed by an element when it is in a compound or by itself.
Answer: FALSE
Diff: 2 Var: 1 Page Ref: Sec. 2.6
Global Obj: Global 1: Demonstrate an understanding of the principles of scientific inquiry.
Learning Obj: LO 2.9 Distinguish atoms from molecules.
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2.3 Short Answer Questions

1) Antoine Lavoisier is often credited with doing more than anyone else to establish chemistry as a quantitative science. What was the significance of Lavoisier's work?
Answer: careful measurements of chemical reactions
Diff: 2 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.

2) When 10.0 g of lead are heated with 1.6 g of sulfur, 11.6 g of lead sulfide are formed. How many grams of lead sulfide form when 10.0 g of lead are heated with 3.0 g of sulfur?
Answer: 11.6 g
Diff: 3 Var: 4 Page Ref: Sec. 2.2
Global Obj: Global 4: Demonstrate the quantitative skills needed to succeed in chemistry.
Learning Obj: LO 2.3 Calculate the amounts of elements form the composition of a compound.

3) Describe what happens in a chemical reaction.
Answer: The arrangement of atoms changes.
Diff: 2 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.

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4) In light of present day knowledge, comment on Dalton's proposal that atoms are indivisible.
Answer: Radioactive elements decompose into elements that are different from the parent element and emit particles in the process.
Diff: 3 Var: 1 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

5) Explain why Mendeleev left gaps in his periodic table of the elements.
Answer: Mendeleev left gaps in his periodic table so that elements with similar properties could be grouped together. He correctly predicted that the gaps would correspond to elements that had not been discovered at that time.
Diff: 3 Var: 1 Page Ref: Sec. 2.5
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.
Learning Obj: LO 2.8 Describe how the elements are arranged in the periodic table and why the arrangement is important.

2.4 Essay Questions

1) What is the significance of the Law of Conservation of Mass in waste disposal?
Diff: 3 Var: 1 Page Ref: Sec. 2.2
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.
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Learning Obj: LO 2.2 Describe the significance of the laws of conservation of mass and definite proportion.

2) Distinguish between a compound and a mixture.
Diff: 2 Var: 2 Page Ref: Sec. 2.3
Global Obj: Global 2: Demonstrate the ability to think critically and employ critical thinking skills and Global 8: Communicate effectively in writing.
Learning Obj: LO 2.4 Explain why the idea that matter is made of atoms in a theory.

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