General Chemistry Atoms to Reactions 1st edition Revell Test Bank

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Name:_____ Class:_____ Date:_____

Chapter 1 Matter and Measurement

1. Which of the following career fields are connected to chemistry?
   a. biology and medicine
   b. physics and engineering
   c. agriculture and food science
   d. environmental, earth, and space science
   e. all of the above

ANSWER: e

2. A scientific law describes an observation is widely considered true. What else is TRUE of a scientific law?
   a. It will tell us why the observation is true.
   b. It can be used to make predictions.
   c. It is a theory that has been proven true.
   d. All of the above are true.
   e. None of the above are true.

ANSWER: b

3. Which of the following is NOT true about a theory?
   a. A theory can be considered a way of thinking about a particular topic.
   b. A theory is an idea that is supported by experimental evidence.
   c. A theory is part of the scientific method.
   d. A theory can change based on new evidence.
   e. A theory is an idea that is completely unproven.

ANSWER: e

4. A hypothesis is
   a. a proven fact.
   b. an experimental procedure.
   c. a tentative explanation that has not been tested.
   d. an idea that has been tested and refined.
   e. a statement that describes observations that are true in widely varying circumstances.

ANSWER: c

5. According to the scientific method, what is the next step after developing a hypothesis?
   a. draw conclusions
   b. devise and conduct experiments
   c. develop a theory
   d. share results with other scientists
   e. develop another hypothesis

ANSWER: b

6. Which of the following is TRUE about the scientific method?

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a. First, observations are made, then new ideas are formulated, and it ends with testing.
b. The first step is to make conclusions.
c. It is a cyclic process.
d. The last step is to run experiments.
e. None of the above.

ANSWER: c

7. Chemistry is often called the central science. Why?

ANSWER: Chemistry is used in many other scientific fields such as biology, physics, agriculture, and engineering.

8. What is chemistry?

ANSWER: Chemistry is the study of what substances are made of and how they behave.

9. How do you interact with chemistry in your daily life?

ANSWER: Chemistry is everywhere. Everything you do is impacted by chemistry!

10. Briefly explain the scientific method.

ANSWER: The scientific method is a cyclic process of making observations, formulating new ideas, and then testing those ideas with experiments.

11. An element is defined as

a. a substance that is made of only one type of atom.
b. anything that has mass and takes up volume.
c. a substance that can be broken down into simpler substances.
d. a combination of two or more pure substances.
e. a substance composed of two or more types of atoms bound together in a fixed ratio.

ANSWER: a

12. A compound is a substance that

a. contains more than one type of atom present in fixed ratios.
b. contains only one type of atom.
c. contains more than one type of atom present in different ratios.
d. can contain one or many types of atoms.
e. must contain at least three different types of atoms.

ANSWER: a

13. Which of the following is an element?

a. water (H_2O)
b. oxygen (O_2)
c. sucrose ($C_{12}H_{22}O_{11}$)

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d. sodium chloride (NaCl)

e. carbon dioxide (CO_2)

ANSWER: b

14. Which of the following is a compound?
    a. copper (Cu)
    b. fluorine (F_2)
    c. neon (Ne)
    d. carbon (C)
    e. nitrogen monoxide (NO)

ANSWER: e

15. Which of the following is an example of a heterogeneous mixture?
    a. salt water
    b. sugar dissolved in coffee
    c. air
    d. salad
    e. ketchup

ANSWER: d

16. Which of the following characteristics best describes a liquid?
    a. Has a definite volume and a definite shape.
    b. Does not have a definite volume nor shape.
    c. Has a definite volume, but not a definite shape.
    d. The particles vibrate within their spaces in a framework.
    e. The particles move freely with very little interaction with each other.

ANSWER: c

17. What is the process of a liquid transitioning into a gas called?
    a. melting
    b. vaporization
    c. freezing
    d. sublimation
    e. condensation

ANSWER: b

18. Which of the following is an example of a homogenous mixture?
    a. a soda with ice
    b. oil and water
    c. chicken noodle soup

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d. saltwater
e. sand and rocks

ANSWER: d

19. Which of the following is an example of a chemical change?
a. You boil some water for pasta.
b. You pour the excess pasta water down the drain.
c. The steam from the water turns to liquid on your glasses.
d. You wipe the water from your glasses.
e. You digest your food.

ANSWER: e

20. If liquid water is frozen into solid ice, what is happening on a molecular level?
a. The molecules get closer together and have less energy.
b. The molecules get further apart and have less energy.
c. The molecules get closer together and have more energy.
d. The molecules get further apart and have more energy.
e. No change in distance or energy occurs.

ANSWER: b

21. What happens to the starting substances as they are converted into products in an endothermic reaction?
a. The energy of the substances does not change.
b. The energy of the substances decreases.
c. The energy of the substances increases.
d. The substances become less reactive.
e. The substances become more stable.

ANSWER: c

22. What type of mixture has a composition that is the same throughout?

ANSWER: Homogenous mixture

23. What is the difference between the composition and structure of a material?

ANSWER: The composition of a material is the components that make up the material. The structure of a material is how those components are arranged.

24. What are the differences between atoms, elements, and compounds?

ANSWER: Atoms are the fundamental unit of matter. All matter is made up of atoms. An element is the simplest form of matter. Every element is made up of one type of atom. Compounds are composed of more than one type of atom, bound together in fixed ratios.

25. If a chemical change has occurred, what must be true?

ANSWER: If a chemical change has occurred, a chemical reaction has occurred, and we have made a new,

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chemically distinct substance.

26. Water is pumped to the top of a water tower to increase the municipal water pressure. Does the water at the top of the tower have more or less potential energy than the water at the base of the tower?
ANSWER: The water at the top has more potential energy than the water at the base due to its position.

27. Which of the following is NOT an SI base unit?
a. meters
b. seconds
c. amperes
d. grams
e. candela
ANSWER: d

28. What is the SI unit of temperature?
a. degree Celsius
b. degree Fahrenheit
c. Kelvin
d. ampere
e. joule
ANSWER: c

29. What is the prefix for $\frac{1}{1000}$ in the SI system?
a. centi-
b. kilo-
c. micro-
d. milli-
e. mega-
ANSWER: d

30. The typical human body temperature is 98.6 °F. What is this temperature in Kelvin?
a. 310.2 K
b. 37.0 K
c. 371.8 K
d. 209.5 K
e. 482.6 K
ANSWER: a

31. Which of the following is the SI unit for length?
a. centimeter

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b. foot
c. meter
d. kilometer
e. mile

ANSWER: c

32. Convert 315.15 K to degrees Celsius.
a. 588.30 °C
b. 107.6 °C
c. 42.00 °C
d. 5.556 °C
e. 315.15 °C

ANSWER: c

33. How many megagrams are in 1 gram?
a. 1×10^{3} Mg
b. 1×10^{-3} Mg
c. 1×10^{-6} Mg
d. 1×10^{-9} Mg
e. 1×10^{6} Mg

ANSWER: c

34. What is the volume of a sphere with a radius of 3.2 cm? The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$.
a. 44 cm^3
b. 140 cm^3
c. 43 cm^3
d. 1.0×10^{2} cm^3
e. 78 cm^3

ANSWER: b

35. How many milligrams are equal to 1 gram?
a. 0.001 mg
b. 0.01 mg
c. 100 mg
d. 1000 mg

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e. 1,000,000 mg

ANSWER: d

36. Which of the following substances will sink in water (d = 1.0 g/mL)?

a. acetone (d = 0.78 g/mL)

b. vegetable oil (d = 0.92 g/mL)

c. honey (d = 1.42 g/mL)

d. All of the above will sink in water.

e. None of the above will sink in water.

ANSWER: c

37. How many micrometers are in 1 meter?

ANSWER: There are 1,000,000 micrometers in 1 meter.

38. Why is it important to use correct units consistently?

ANSWER: Measurements don't have any meaning without a unit attached. Units of measurement are quantities with accepted values that can be used to communicate between people. Additionally, units can help you check whether you've done a calculation correctly.

39. The temperature of a typical refrigerator is about 4 °C. What is this temperature in degrees Fahrenheit?

ANSWER: $°\text{F} = \frac{9}{5}°\text{C} + 32 = \frac{9}{5}(4\ °\text{C}) + 32 = 39\ °\text{F}$

40. A cube has a side length of 5.3 cm and a mass of 125.8 g. Will this cube float in water? The density of water is 1.0 g/cm^3.

ANSWER: d = 0.84 g/cm^3, so the cube will float in water

41. A cube with a side length of 5.00 cm has a mass of 131 g. Calculate the volume (in cm^3) and density (in g/cm^3) of the cube.

ANSWER: $V = l^3 = (5.00\ \text{cm})^3 = 125\ \text{cm}^3$

$$d = \frac{m}{V} = \frac{131\ \text{g}}{125\ \text{cm}^3} = 1.05\ \text{g/cm}^3$$

42. A student measures 210.50 mL of water for an experiment in her chemistry lab. How many significant digits does 210.50 have?

a. 1

b. 2

c. 3

d. 4

e. 5

ANSWER: e

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43. Which of the following measurements has the highest precision?
    a. 15.0 cm
    b. 15.000 cm
    c. 15 cm
    d. 15.00 cm
    e. 1.5 cm

ANSWER: b

44. If a set of measurements are all very close to each other, but are far away from the true value, they are
    a. accurate and precise.
    b. accurate but not precise.
    c. precise but not accurate.
    d. neither accurate nor precise.
    e. none of the above.

ANSWER: c

45. Which of the following numbers has three significant digits?
    a. 0.12
    b. 3.850
    c. 305
    d. 432.0
    e. 0.001

ANSWER: c

46. When multiplying 3.45 by 2.9, how many significant digits should the result have?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

ANSWER: b

47. The height of a book is measured as 8.0230 cm. How many significant digits are in this measurement?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

ANSWER: e

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48. How many significant digits are in the measurement 0.0930?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

ANSWER: c

49. The mass of molten aluminum that is needed to make a specific car part is 275 g. Which of the following measurements is the most accurate?
    a. 280 g
    b. 278.714 g
    c. 288.32 g
    d. 300 g
    e. 276.4 g

ANSWER: e

50. A pallet of lumber has 256 boards on it. If the mass of the boards on the pallet weighs 928.96 kg, how much does each board weigh using an appropriate number of significant digits?
    a. 3.6288 kg
    b. 3.629 kg
    c. 3.63 kg
    d. 3.6 kg
    e. 4 kg

ANSWER: a

51. What kind of numbers are exempt from significant digits?
    a. measured numbers
    b. decimal numbers
    c. exact numbers
    d. large numbers
    e. numbers in scientific notation

ANSWER: c

52. Kris walks 1.32 km from his home to the hardware store, 1.1 km from the hardware store to the grocery store, and 1.435 km from the grocery store back to home. What is the total distance he traveled on this trip using appropriate significant digits?
    a. 3.86 km
    b. 3.9 km
    c. 4 km
    d. 4.0 km

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e. 3.855 km

ANSWER: b

53. Accuracy and precision are terms that scientists use to describe the qualities of a data set. What does the accuracy of a data set indicate?

ANSWER: The accuracy of a data set indicates how well the data reflects the true value.

54. Calculate the area of a rectangle with side lengths of 3.042 cm and 2.1 cm. Report your answer with appropriate units and significant digits.

ANSWER: $A = l \times w = 3.042 \text{ cm} \times 2.1 \text{ cm} = 6.4 \text{ cm}^2$

55. A student adds 5.0 mL of water to a graduated cylinder. They then add an insoluble solid to the graduated cylinder and record the volume of the water and solid as 9.15 mL. What is the volume of the solid reported using appropriate significant figures?

ANSWER: $9.15 \text{ mL} - 5.0 \text{ mL} = 4.2 \text{ mL}$

56. If a set of measurements reflects the true value of a measurement well, but the individual measurements are scattered away from the true value, what can be said about the accuracy and precision of these measurements?

ANSWER: The set of measurements is accurate (reflects the true value), but the measurements are not precise (they are far away from each other).

57. If you have a pencil that weighs 4.632 g, a pen that weighs 7.15 g, and a stylus that weighs 20.7 g, what is the total mass of these three objects? Report the answer using correct significant digits.

ANSWER: $4.632 \text{ g} + 7.15 \text{ g} + 20.7 \text{ g} = 32.5 \text{ g}$

58. Ibuprofen is a commonly used over-the-counter medication used to treat body aches and pains. A common dose of ibuprofen is 400 mg. What is the mass of this dose of ibuprofen in grams?

a. 40 g
b. 4 g
c. 0.4 g
d. 0.04 g
e. 0.004 g

ANSWER: c

59. Convert 100 m to kilometers (km).

a. 0.001 km
b. 0.1 km
c. 1 km
d. 10,000 km
e. 100,000 km

ANSWER: b

60. How many centimeters are in 3.4 m?

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a. 0.0034 cm
b. 0.034 cm
c. 340 cm
d. 3400 cm
e. 34000 cm

ANSWER: c

61. Convert 4.7 L to milliliters.
a. 0.0047 mL
b. 0.047 mL
c. 4700 mL
d. 47000 mL
e. 470000 mL

ANSWER: c

62. The speed of light in a vacuum is 2.99×10^8 m/s. What is this value in miles per hour?

a. 1.86×10^5 miles per hour
b. 51.6 miles per hour
c. 1.34×10^8 miles per hour
d. 6.69×10^8 miles per hour
e. 1.73×10^{15} miles per hour

ANSWER: d

63. An Olympic-size swimming pool is 50. m × 25 m. What is the surface area of the pool in square feet?
a. 4100 ft^2
b. 1300 ft^2
c. 120 ft^2
d. 13,000 ft^2
e. 380 ft^2

ANSWER: d

64. Which of the following is the conversion of 100 mL to cm^3?
a. 1 cm^3
b. 10 cm^3
c. 100 cm^3
d. 1000 cm^3

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e. 10000 cm^3

ANSWER: c

65. How many liters are in 1 gallon of lemonade? 1 L = 0.264 gal

a. 0.264 L
b. 1.26 L
c. 2.32 L
d. 3.79 L
e. 7.58 L

ANSWER: d

66. Water is one of the few substances whose solid phase is less dense than its liquid phase. The density of liquid water is about 1.00 g/mL, whereas the density of ice is about 0.920 g/mL. Approximately how much does a 100.00 mL sample of ice weigh?

a. 100. g
b. 92.0 g
c. 109 g
d. 100.92 g
e. 99.08 g

ANSWER: b

67. How many square meters, m^2, are in 150 ft^2?

a. 46 m^2
b. 14 m^2
c. 490 m^2
d. 1600 m^2
e. 0.30 m^2

ANSWER: b

68. A water tank has a volume of 5 m^3. What is this volume in liters?

a. 0.005 L
b. 0.05 L
c. 50 L
d. 500 L
e. 5000 L

ANSWER: e

69. A bag of pretzels has 110 kilocalories per serving. How many kilojoules are in one serving? 4.184 kJ = 1 kcal

a. 460 kJ

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b. 26 kJ
c. 156 kJ
d. 440 kJ
e. 4.2 kJ

ANSWER: a

70. What is the mass of an iron block that has a volume of 24 cm^3? The density of iron is 7.87 g/cm^3.
ANSWER: 190 g

71. Convert 142 mg to kilograms (kg).
ANSWER: 1.42×10^{-4} kg

72. A student is trying to convert a measurement in millimeters to meters, but after performing the calculation, gets units of mm^2/m. What mistake was made? How would the student correct this?
ANSWER: The reciprocal of the conversion factor was used. The conversion factor should be flipped.

73. The flow of coolant through a pipe is 4.50 mL/s. What would the flow rate be in liters per hour?
ANSWER: 16.2 L/h

74. A cylindrical gasoline storage tank has a radius of 1.5 m, and a height of 3.0 m. What is the volume of this tank in liters? The volume of a cylinder is given by $V = \pi r^2 h$.

ANSWER: 21,000 L

75. The density of a certain motor oil is 0.860 g/cm^3. How much would 175 L of this oil weigh (in kg)?
ANSWER: 151 kg

76. Matter is neither created nor destroyed in chemical reactions. This is a statement of _____
a. the first law of thermodynamics.
b. the law of conservation of mass.
c. the law of constant composition.
d. the law of multiple proportions.
e. the law of conservation of energy.

ANSWER: b

77. Which of the following statements is NOT part of Dalton's atomic theory?
a. Elements are made of atoms.
b. The atoms of each element are unique.
c. Atoms can join together in whole number ratios.
d. Atoms are made up of subatomic particles.
e. Atoms are unchanged in chemical reactions.

ANSWER: d

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78. The law of multiple proportions states that _____
   a. atoms may be combined in ANY proportions to form different compounds.
   b. when two elements are able to form multiple compounds, the elements combine in different whole-number ratios.
   c. two elements will always form compounds with the same whole-number ratio.
   d. the total mass of the products is equal to the total mass of the reactants.
   e. atoms of the same element are identical in size and mass.

ANSWER: b

79. Over time, 15 kg of iron reacts with oxygen in the presence of water to form iron(III) oxide, or rust. If the mass of the rust is 21.45 kg, how much oxygen had to react to produce that amount of rust?
ANSWER: 6.45 kg

80. Which of the following best illustrates the law of conservation of mass?
   a. A cooked egg weighs less than a raw egg.
   b. A piece of paper burns and produces less mass in ashes.
   c. A cube of ice weighs the same as the puddle of water it forms after melting.
   d. A plant grows and increases its mass by absorbing sunlight.
   e. Water evaporates as its mass disappears.

ANSWER: c

81. Which of the following observations would VIOLATE the law of conservation of mass?
   a. Atoms rearranged during a chemical reaction.
   b. A sealed reaction vessel shows no change before and after a chemical reaction.
   c. A burning log loses mass because gases escape into the air.
   d. The mass of the reactants is equal to the mass of the products for a chemical reaction.
   e. A sealed reaction vessel shows a decrease in mass after a chemical reaction.

ANSWER: e

82. When a chemical reaction occurs, which of the following must be TRUE about the products?
   a. The products will be the same as the reactants.
   b. The total mass of the products will be the same as the total mass of the reactants, but they don't have to be the same atoms.
   c. The number of atoms for each element will be the same, but they will be arranged differently.
   d. The number of atoms for each element will be the same and they will be arranged in the same way.
   e. The number of atoms for each element cannot be determined from this information.

ANSWER: c

83. In what ratios can atoms combine to form compounds?
ANSWER: Atoms can only combine in whole number ratios.

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84. If 33 g of substance A reacts with 12 g of substance B, what will the mass of the products be?
    a. 33 g
    b. 12 g
    c. 21 g
    d. 45 g
    e. 57 g

ANSWER: d

85. The colors in fireworks come from chemicals that burn different colors. For example, red fireworks usually get their color from a strontium compound like strontium chloride ($SrCl_2$). If 39.85 g of $SrCl_2$ reacts with 8.11 g of O_2, what will be the total mass of the products?

ANSWER: The mass of the products will be the same as the reactants according to the law of conservation of mass. Therefore, the total mass of the products is 47.96 g.

86. Based on its location in the periodic table, which of these elements is a metal?
    a. carbon
    b. helium
    c. nitrogen
    d. vanadium
    e. iodine

ANSWER: d

87. Which of the following elements has properties most similar to calcium?
    a. potassium
    b. magnesium
    c. sodium
    d. scandium
    e. krypton

ANSWER: b

88. Which of the following elements is a metalloid?
    a. aluminum
    b. tin
    c. phosphorus
    d. arsenic
    e. gallium

ANSWER: d

89. Who was the person that organized the first modern periodic table?

ANSWER: Dimitri Mendeleev

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90. The halogens (group 7A) tend to form what kind of molecules in their elemental form?
ANSWER: diatomic molecules

91. What is the chemical symbol for tin?
a. Ti
b. Sn
c. Tn
d. T
e. Sb
ANSWER: b

92. Group 8A elements are often called noble gases. What is a common property of elements in this group?
a. They are inert, and rarely form compounds.
b. They readily form compounds with other elements.
c. They are highly reactive.
d. They are good conductors of electricity.
e. They are magnetic.
ANSWER: a

93. Where are nonmetals most likely to be found on the periodic table?
ANSWER: Nonmetals are most likely to be found in the upper right corner of the periodic table.

94. The inner transition metals consist of two rows of elements which are usually shown at the bottom of the periodic table. The second row of these elements is called the _____
a. rare earth metals.
b. lanthanide series.
c. actinide series.
d. alkali earth metals.
e. noble series.
ANSWER: c

95. Which of the following elements is in the lanthanide series?
a. barium
b. radium
c. thorium
d. cerium
e. lead
ANSWER: d

96. What is a common property of alkali metals?
ANSWER: Alkali metals are in the far left of the periodic table. The alkali metals are soft and react violently with water or air.

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97. Which period of the periodic table contains the element chromium?
    a. period 1
    b. period 2
    c. period 3
    d. period 4
    e. period 5

ANSWER: d

98. Which of the following particles is/are found outside of the nucleus?
    a. protons
    b. neutrons
    c. electrons
    d. protons and neutrons
    e. electrons and neutrons

ANSWER: c

99. Which experiment led to the discovery of the electron?
    a. gold foil experiment
    b. oil drop experiment
    c. double slit experiment
    d. cathode ray tube experiment
    e. Rutherford scattering experiment

ANSWER: d

100. What did Rutherford's gold foil experiment demonstrate?
    a. The nucleus is small, dense, and positively charged.
    b. The nucleus contains two subatomic particles: protons and neutrons.
    c. Electrons are located in specific energy levels.
    d. Protons are positively charged.
    e. Electrons have a negative charge.

ANSWER: a

101. What was the main conclusion from Millikan's oil drop experiment?
    a. The atom is mostly empty space.
    b. The charge on an electron.
    c. The nucleus is positively charged.
    d. Electrons orbit the nucleus at fixed distances around the nucleus.
    e. Atoms contain neutrons.

ANSWER: b

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102. Which of the following subatomic particles has/have no charge?

a. protons
b. neutrons
c. electrons
d. protons and electrons
e. protons and neutrons

ANSWER: b

103. What model of the atom did J.J. Thomson propose, and how did it describe the structure of the atom?

ANSWER: Thomson proposed the plum pudding model, in which atoms are solid with negative electrons spread throughout a positively charged matrix.

104. How did Rutherford's model of the atom differ from Thomson's model?

ANSWER: Rutherford's model proposed that the atom has a small, dense, positively charged nucleus with electrons orbiting around it. While Thomson's model described the atom as a spherical solid with negative electrons spread throughout a positively charged matrix.

105. Two spheres each having a charge of +2.7 nanocoulombs are separated by a distance of 3.7 mm. Using Coulomb's law, calculate the force of repulsion between these two spheres.

ANSWER: 4.8 mN or 4.8×10^{-3} N

106. What was the quantity determined by the cathode-ray tube experiment?

a. The mass of the electron.
b. The charge of the electron.
c. The mass to charge ratio of the electron.
d. The charge of the proton.
e. The mass to charge ratio of the hydrogen nucleus.

ANSWER: c

107. As a result of Volta's battery, scientist found that they could separate some compounds into their elements. What did this discovery allow them to do?

a. develop the periodic table
b. discover new subatomic particles
c. propose the law of conservation of mass
d. identify how charge particles interact with each other
e. invent new types of batteries

ANSWER: d

108. What is the more formal name for the type of battery that Volta made?

a. dry cell battery
b. nickel cadmium battery
c. lithium ion battery

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d. mercury battery
e. electrochemical cell

ANSWER: e

109. If an ion has 2 more protons than neutrons, what will the charge be on that ion?
a. –2
b. +1
c. +2
d. +4
e. We cannot know with only the given information.

ANSWER: e

110. What is the net charge of an ion with 12 protons, 11 neutrons, and 10 electrons?
a. +2
b. +1
c. –1
d. –2
e. –3

ANSWER: a

111. What is the net charge of an ion with 7 protons, 8 neutrons, and 4 electrons?
a. –4
b. –1
c. +1
d. +2
e. +3

ANSWER: e

112. What is the key idea in Bohr's model of the atom?
ANSWER: Electrons orbit the nucleus like planets orbit the sun.

113. If a neutral atom loses an electron, what will the charge be on the newly formed ion?
ANSWER: +1

114. The atomic number of an element is defined by the _____
a. number of protons.
b. number of neutrons.
c. number of electrons.
d. sum of the number of protons and neutrons.
e. atomic mass.

ANSWER: a

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115. What does the mass number of an atom represent?
a. number of protons
b. number of electrons
c. number of neutrons
d. the sum of the number of protons and neutrons
e. the number of isotopes of an element
ANSWER: d

116. Using the periodic table, determine how many protons and neutrons are in a bromine-79 atom.
ANSWER: Bromine has an atomic number of 35 so it has 35 protons. Subtracting 35 from 79, gives 44 neutrons.

117. Chlorine has two main isotopes: ^{35}Cl and ^{37}Cl. ^{35}Cl has a mass 34.9 u, and an abundance of 75.8%. ^{37}Cl has a mass of about 36.9 u with an abundance of about 24.2%. From this data, calculate the atomic mass of chlorine.
ANSWER: 35.38 u

118. How many neutrons are in an atom of cobalt-60?
a. 27
b. 33
c. 60
d. 32
e. 87
ANSWER: b

119. What is the mass number of an atom that has 20 protons, 22 neutrons, and 20 electrons?
a. 20
b. 22
c. 40
d. 42
e. 62
ANSWER: d

120. What is the charge of the nucleus in an atom?
a. positive
b. negative
c. zero
d. positive or negative, depending on the element
e. switches between positive and negative
ANSWER: a

121. What are isotopes?

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a. Atoms of the same element with the same number of neutrons, but a different number of protons.
b. Atoms of the same element with the same number of protons, but a different number of neutrons.
c. Atoms of the same element with the same number of protons, but a different number of electrons.
d. Atoms of the same element with the same number of electrons, but different number of protons.
e. Atoms of the same element with the same number of neutrons, but different number of electrons.

ANSWER: b

122. What element has an atomic number of 19?
a. calcium
b. sodium
c. potassium
d. fluorine
e. argon

ANSWER: c

123. What is the mass number of an isotope of gallium that has 40 neutrons?
ANSWER: 71

124. What is the chemical symbol for the element with the atomic number of 37?
a. K
b. Sr
c. Cl
d. Ar
e. Rb

ANSWER: e

125. There are two naturally occurring radioactive isotopes of tellurium. An atom of radioactive tellurium has a mass number of 128, how many neutrons does it have?
ANSWER: There are 76 neutrons in this atom.

126. Dichloromethane is a common solvent used in organic chemistry. What is the formula mass of dichloromethane (CH_2Cl_2)?
a. 48.96 u
b. 62.93 u
c. 84.93 u
d. 96.00 u
e. 100.50 u

ANSWER: c

127. What is the percent composition of hydrogen in acetic acid ($C_2H_4O_2$)?
a. 3.4%

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b. 1.6%
c. 6.7%
d. 40%
e. 53%

ANSWER: c

128. Hydrogen peroxide has the chemical formula H_2O_2. If you have 2.00 kg of hydrogen peroxide, how much oxygen by mass do you have?

a. 0.12 kg
b. 0.24 kg
c. 1.00 kg
d. 1.88 kg
e. 2.00 kg

ANSWER: d

129. Sodium bicarbonate, $NaHCO_3$, is commonly used to clean up acid spills in chemistry labs, and to provide leavening to some baked goods. What is the formula mass of this compound?

a. 52.01 u
b. 68.01 u
c. 72.00 u
d. 84.01 u
e. 104.02 u

ANSWER: d

130. What is the formula mass for zinc fluoride (ZnF_2)?

ANSWER: 103.38 u

131. What is the percent mass of oxygen in calcium sulfate ($CaSO_4$)?

ANSWER: 47.0%

132. What is the formula mass of propane (C_3H_8)?

a. 13.02 u
b. 20.08 u
c. 37.04 u
d. 44.11 u
e. 56.14 u

ANSWER: d

133. What is the formula mass of sodium sulfide, Na_2S?

a. 55.06 u

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b. 78.05 u
c. 81.13 u
d. 87.13 u
e. 119.2 u

ANSWER: b

134. What is the percent mass of chlorine in $FeCl_3$?
ANSWER: 65.6% Cl

135. Aluminum oxide (Al_2O_3) forms when aluminum is exposed to oxygen. What is the mass percent of aluminum in aluminum oxide?
a. 26.47% Al
b. 47.38% Al
c. 52.92% Al
d. 62.79% Al
e. 73.88% Al

ANSWER: c

136. Sodium nitrate has the formula $NaNO_3$. What is the formula mass of sodium nitrate? If you have a 5.00 kg jar of sodium nitrate in the laboratory stockroom, how much of that 5.00 kg bottle is sodium by mass?
ANSWER: The formula mass of sodium nitrate is 85.00 u. Sodium makes up approximately 1.35 kg of the 5.00 kg of sodium nitrate.

137. How many atoms are in a molecule of acetic acid ($HC_2H_3O_2$)?
a. 3
b. 4
c. 6
d. 7
e. 8

ANSWER: e

138. In the compound $NaHSO_2$, which element contributes the least to the mass of the compound?
a. hydrogen
b. oxygen
c. sodium
d. sulfur
e. sulfur or oxygen

ANSWER: a

139. If you have one mole of carbon dioxide, how many molecules of carbon dioxide do you have?
a. 1 molecule

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b. 44.01 molecules
c. 6.02×10^{23} molecules
d. 1.66×10^{24} molecules
e. 2.40×10^{24} molecules

ANSWER: c

140. How many moles contain 3.01×10^{23} molecules of HCl?
a. 0.250 moles
b. 0.500 moles
c. 2.00 moles
d. 8.26×10^{21} moles
e. 1.81×10^{47} moles

ANSWER: b

141. How many molecules are in 3.00 moles of HNO_3?
a. 4.98×10^{24} molecules
b. 6.02×10^{23} molecules
c. 1.81×10^{24} molecules
d. 3 molecules
e. 2.01×10^{23} molecules

ANSWER: c

142. What is the molar mass of CH_3OH?
a. 20.04 g/mol
b. 29.02 g/mol
c. 31.04 g/mol
d. 32.05 g/mol
e. 78.03 g/mol

ANSWER: d

143. How many molecules are in 0.233 moles of carbon monoxide (CO)?
a. 3.87×10^{25} molecules CO
b. 2.58×10^{24} molecules CO
c. 6.52 molecules CO
d. 1.40×10^{23} molecules CO
e. 8.32×10^{-3} molecules CO

ANSWER: d

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144. How many hydrogen atoms are in one mole of acetic acid ($HC_2H_3O_2$)?

a. 6.02×10^{23} H atoms
b. 1.51×10^{23} H atoms
c. 2.01×10^{23} H atoms
d. 1.81×10^{24} H atoms
e. 2.40×10^{24} H atoms

ANSWER: e

145. If a sample of calcium iodide (CaI_2) has 7.98×10^{24} formula units, what is the mass of calcium iodide in the sample?

a. 0.0132 kg
b. 0.787 kg
c. 1.63 kg
d. 2.21 kg
e. 3.90 kg

ANSWER: e

146. Phosphoric acid has the formula H_3PO_4. If you have one mole of phosphoric acid, how many moles of atoms do you have?

a. 1
b. 3
c. 4
d. 7
e. 8

ANSWER: e

147. How many moles contain 5.28×10^{23} atoms of copper?

ANSWER: 0.877 moles Cu

148. What is the molar mass of phosphoric acid (H_3PO_4)?

ANSWER: 98.00 g/mol

149. If you have 873.22 g of aluminum oxide (Al_2O_3), how many moles of aluminum oxide do you have? The molar mass aluminum oxide is 101.96 g/mol.

ANSWER: 8.56 moles Al_2O_3

150. Potassium iodide (KI) has a molar mass of 166.00 g/mol. If you have 0.611 moles of potassium iodide, how many grams of potassium iodide do you have?

ANSWER: 101.43 g KI

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151. How many molecules are in 5.00 moles of O_2?
a. 1.20×10^{24} molecules
b. 8.31×10^{-24} molecules
c. 3.01×10^{24} molecules
d. 6.02×10^{24} molecules
e. 9.03×10^{25} molecules
ANSWER: c

152. What is the mass of 7.32×10^{24} formula units of sodium sulfate (Na_2SO_4)?
a. 1720 g
b. 12.2 g
c. 863 g
d. 9.79 g
e. 5.84 g
ANSWER: a

153. How many formula units are in a 35.00 g sample of magnesium sulfate ($MgSO_4$)?
ANSWER: 1.75×10^{23} formula units of $MgSO_4$

154. A given sample of iron(II) bromide ($FeBr_2$) contains 1.99×10^{22} formula units of iron(II) bromide. How many grams of iron(II) bromide is this?
ANSWER: 7.12 g $FeBr_2$

155. What measurement describes the number of waves that pass a point over a period of time?
a. wavelength
b. speed
c. frequency
d. energy
e. photoelectric effect
ANSWER: c

156. What measurement describes the distance between the same points on adjacent waves?
a. wavelength
b. speed
c. frequency
d. energy
e. photoelectric effect
ANSWER: a

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157. What is the frequency of a green laser pointer that has a wavelength of 532 nm?
a. 1.97×10^{14} Hz
b. 5.32×10^{14} Hz
c. 6.19×10^{14} Hz
d. 5.64×10^{14} Hz
e. 7.32×10^{14} Hz
ANSWER: d

158. What is the wavelength of the radio waves emitted for a station with a frequency of 97.9 MHz?
a. 3.06×10^{7} m
b. 1.21×10^{7} m
c. 6.15 m
d. 1.21 m
e. 3.06 m
ANSWER: e

159. What is the energy of an X-ray photon that has a wavelength of 0.25 nm?
a. 4.6×10^{-16} J
b. 2.5×10^{-17} J
c. 1.7×10^{-19} J
d. 4.2×10^{-17} J
e. 8.0×10^{-16} J
ANSWER: e

160. Which of the following statements is TRUE?
a. The speed of light is proportional to energy.
b. Energy is inversely proportional to frequency.
c. Wavelength is inversely proportional to frequency.
d. Energy is proportional to wavelength.
e. The energy of electromagnetic radiation is constant.
ANSWER: c

161. What is the energy of a UV photon that has a wavelength of 275 nm?
a. 5.60×10^{-19} J
b. 7.23×10^{-19} J
c. 8.21×10^{-19} J

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d. 4.07×10^{-19} J

e. 1.69×10^{-19} J

ANSWER: b

162. A laser emits a pulse of light with an energy of 30.5 mJ at a wavelength of 1064 nm. How many photons are emitted in the pulse?

a. 1.63×10^{17} photons

b. 4.05×10^{19} photons

c. 9.17×10^{19} photons

d. 2.36×10^{19} photons

e. 1.23×10^{20} photons

ANSWER: a

163. The minimum energy required to remove an electron from tin is 7.08×10^{-19} J. Which of the following frequencies would be able to remove an electron from tin?

a. 48.2 MHz

b. 1070 THz

c. 984 GHz

d. 498 GHz

e. none of the above

ANSWER: b

164. Which electron energy level transitions would emit a photon with the highest frequency?

a. $2 \rightarrow 1$

b. $3 \rightarrow 1$

c. $4 \rightarrow 1$

d. $1 \rightarrow 5$

e. $1 \rightarrow 6$

ANSWER: c

165. What is the photoelectric effect?

ANSWER: The photoelectric effect is the phenomenon in which electrons are emitted from a material's surface when it absorbs light of sufficient energy.

166. A broad-spectrum sunscreen provides protection from ultraviolet (UV) light with wavelengths ranging from 100 to 400 nanometers (nm). Determine the range of the frequency and energy of this light.

ANSWER: frequency range: 3.00×10^{15} to 7.50×10^{14} Hz

energy range: 4.97×10^{-19} to 1.99×10^{-18} J

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167. A flame test was conducted on a solution containing an unknown metal ion from the following list. Light with a frequency of 5.43×10^{14} Hz was observed. Using the following information, what is the wavelength (in nm) of light observed and the identity of the metal ion present in the solution?

Metal	Flame Test Color
Sodium	yellow
Potassium	violet
Barium	green
Strontium	red

Color	Wavelengths (nm)
Violet	380–450
Blue	450–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

ANSWER: $\lambda = 552$ nm
The identity of the metal ion is barium.

168. Argon has an ionization energy of 1450 kJ/mol. What is the minimum frequency of light that can ionize a single argon atom?
ANSWER: 3.64×10^{15} Hz

169. What is a flame test? How can it be used to identify an element?
ANSWER: A flame test is a procedure used to detect the presence of metal ions based on the characteristic color they emit when heated in a flame. During a flame test, a solution containing a metal ion is placed in a flame, and the electrons in the metal ions absorb
energy, becoming excited to higher energy levels. When these electrons return to their ground state, they release energy in the form of light, with a color characteristic of the metal ion.

170. What is the wavelength of an electron traveling at 2.5×10^{6} m/s? The mass of an electron is 9.11×10^{-31} kg.

a. 3.6×10^{-10} m
b. 4.2×10^{-10} m
c. 1.9×10^{-9} m
d. 2.9×10^{-10} m
e. 4.0×10^{-9} m

ANSWER: d

171. What is the wavelength of a tennis ball served at 195 km/h? The mass of the tennis ball is 56.0 g.

a. 1.9×10^{-38} m
b. 4.9×10^{-38} m

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c. 6.1×10^{-38} m

d. 2.2×10^{-34} m

e. 1.3×10^{-39} m

ANSWER: c

172. Which particle would have the shortest wavelength when traveling at 10% of the speed of light?

a. electron, 9.1094×10^{-31} kg

b. proton, 1.6726×10^{-27} kg

c. neutron, 1.6749×10^{-27} kg

d. muon, 1.8835×10^{-28} kg

e. tau, 3.1675×10^{-27} kg

ANSWER: e

173. Which of the following phenomena is most directly explained by the wave nature of electrons?

a. the diffraction of electrons by a crystal

b. the quantization of energy levels in an atom

c. the photoelectric effect

d. the emission of photons from excited atoms

e. the radioactive decay of unstable nuclei

ANSWER: a

174. Which of the following is a consequence of Heisenberg's uncertainty principle?

a. The energy of an electron is quantized.

b. The quantization of energy levels in an atom

c. Electrons exhibit wave-particle duality.

d. The exact position and momentum of an electron cannot be known simultaneously.

e. Electrons in an atom occupy specific energy levels.

ANSWER: d

175. Which of the following statements about wave-particle duality is INCORRECT?

a. All matter exhibits wave-particle duality.

b. The wave nature of matter is more pronounced for macroscopic objects.

c. The de Broglie wavelength of an object is inversely proportional to its speed.

d. The wave-particle duality is a fundamental concept in quantum mechanics.

e. The double-slit experiment can be used to demonstrate the wave nature of electrons.

ANSWER: b

176. The diameter of a silicon atom used in a semiconductor is 210 pm. If the position of an electron is known within this diameter, determine the minimum uncertainty in its speed. The mass of the electron is 9.11×10^{-31}

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kg.

a. 7.0×10^{5} m/s
b. 9.5×10^{5} m/s
c. 2.8×10^{5} m/s
d. 1.3×10^{6} m/s
e. 5.2×10^{6} m/s

ANSWER: c

177. The diameter of a hydrogen atom is approximately 120 pm. If the position of an electron is known within this diameter, what is the minimum uncertainty in the electron's speed? The mass of the electron is 9.11×10^{-31} kg.

ANSWER: 4.8×10^{5} m/s

178. When a radioactive carbon-14 nucleus decays, it emits a particle with a mass of 9.11×10^{-31} kg and a speed of 2.15×10^{7} m/s. What is the de Broglie wavelength of this particle? If the uncertainty in the momentum ($m\Delta u$) is 2.1×10^{-21} kg·m/s, what is the minimum possible uncertainty in the position of this particle?

ANSWER: $\lambda_{\text{particle}} = 3.38\times10^{-11}$ m
$\Delta x = 2.5\times10^{-14}$ m

179. What occurs to waves when they undergo constructive and destructive interference?

ANSWER: Constructive interference occurs when waves meet in phase, meaning their crests and troughs align. When this happens, the amplitudes of the waves add together, resulting in a wave with a larger amplitude than either of the original waves. Destructive interference occurs when waves meet out of phase, meaning the crest of one wave aligns with the trough of another. In this case, the amplitude of the resulting wave is reduced or canceled out.

180. How many electrons can occupy a *p* sublevel?

a. 2
b. 3
c. 6
d. 10
e. 14

ANSWER: c

181. How many orbitals are there in an *f* sublevel?

a. 1
b. 3
c. 6
d. 7

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e. 14

ANSWER: d

182. What is the maximum number of electrons that can be present within the third energy level?

a. 32
b. 18
c. 14
d. 8
e. 2

ANSWER: b

183. Which of the following values is NOT a possible value for the principal quantum number?

a. 0
b. 1
c. 2
d. 5
e. 10

ANSWER: a

184. Which of the following values is a solution for the spin quantum number?

a. 0
b. 1
c. –2
d. –1
e. –½

ANSWER: e

185. Which of the following sets of quantum numbers is possible for an electron in a 3*p* orbital?

a. [3, 2, –1, +½]
b. [4, 3, –2, +½]
c. [3, 2, –1, +½]
d. [3, 0, 0, –½]
e. [3, 1, 0, +½]

ANSWER: e

186. What are the possible m_l values for an electron in a 3*d* orbital?

a. –1, 0, 1
b. –2, –1, 0, 1, 2
c. –3, –2, –1, 0, 1, 2, 3
d. +½, –½

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e. 3, 2, 1, 0

ANSWER: b

187. Which of the following sets of quantum numbers is NOT possible?

a. [5, 2, –1, –½]
b. [4, 0, 0, +½]
c. [3, 2, –1, +½]
d. [3, 0, –1, –½]
e. [4, 2, 0, +½]

ANSWER: d

188. What is the Pauli exclusion principle?

ANSWER: The Pauli exclusion principle states that no two electrons in a single atom can have the same four quantum numbers.

189. What are the possible quantum numbers for an electron in a 4*s* orbital?

ANSWER: [4, 0, 0, +½] or [4, 0, 0, –½]

190. What is the level and sublevel of an electron with the quantum numbers of [3, 2, 0, –½]?

ANSWER: 3*d*

191. How many orbitals are possible that have a principal quantum number of 4? How many electrons can occupy those orbitals?

ANSWER: There are 16 possible orbitals in $n = 4$. 32 electrons can occupy the 16 orbitals.

192. Which element has the following electron configuration as a neutral atom?

$1s^2 2s^2 2p^4$

a. C
b. N
c. O
d. F
e. S

ANSWER: c

193. Which element has the following electron configuration as a neutral atom?

$1s^2 2s^2 2p^6$

a. C
b. N
c. O
d. F

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e. Ne

ANSWER: e

194. What is the electron configuration for a strontium atom?

a. [Ar]$4s^2 3d^{10} 4p^6$

b. [Ar]$5s^2 4d^{10} 5p^6$

c. [Kr]$5s^2$

d. [Kr]$5s^2 4d^{10} 5p^6$

e. [Ar]$5s^2 4d^1$

ANSWER: c

195. Which of the following electron configurations represents an atom with 7 valence electrons?

a. [Ar]$4s^2 3d^{10} 4p^6$

b. [Ar]$5s^2 4d^{10} 5p^5$

c. [Kr]$5s^2 4d^7$

d. [Kr]$5s^2 4d^{10} 5p^3$

e. [Ar]$5s^2 4d^5$

ANSWER: b

196. How many valence electrons are present in an arsenic atom?

a. 2

b. 5

c. 8

d. 3

e. 15

ANSWER: b

197. How many valence electrons are present in a tin atom?

a. 2

b. 5

c. 8

d. 4

e. 14

ANSWER: d

198. What is the electron configuration for a phosphide ion, P^{3-}?

a. $1s^2 2s^2 2p^6 3s^2 3p^3$

b. $1s^2 2s^2 2p^6 3s^2 3p^4$

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c. $1s^2 2s^2 2p^6 3s^2 3p^5$

d. $1s^2 2s^2 2p^6 3s^2 3p^6$

e. $1s^2 2s^2 2p^6 3s^2 3p^2 3d^1$

ANSWER: d

199. Which of the following ions is NOT isoelectronic with argon?

a. P^{3-}

b. S^{2-}

c. Cl^-

d. K^+

e. Na^+

ANSWER: e

200. What is the electron configuration for a calcium ion, Ca^{2+}?

ANSWER: $1s^2 2s^2 2p^6 3s^2 3p^6$

201. What is the electron configuration for a neutral nitrogen atom?

ANSWER: $1s^2 2s^2 2p^3$

202. Write the electron configuration for bromine using noble gas shorthand. How many inner, outer, and valence electrons does bromine have?

ANSWER: $[Ar]4s^2 3d^{10} 4p^5$
Bromine has 18 inner electrons, 17 outer electrons, and 7 valence electrons.

203. Write the electron configuration for titanium using noble gas shorthand. How many inner, outer, and valence electrons does titanium have?

ANSWER: $[Ar]4s^2 3d^2$
Titanium has 18 inner electrons, 4 outer electrons, and 2 valence electrons.

204. How many valence electrons does carbon have?

a. 2

b. 4

c. 6

d. 8

e. 0

ANSWER: b

205. How many valence electrons do elements in group 17 (7A) have?

a. 2

b. 4

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c. 6
d. 7
e. 8

ANSWER: d

206. How many valence electrons do elements in group 2 (2A) have?
a. 2
b. 4
c. 6
d. 7
e. 8

ANSWER: a

207. Which of the following elements have a valence-level electron configuration of s^2p^1?
a. Be
b. Na
c. K
d. Sc
e. Al

ANSWER: e

208. Which of the following elements have a valence-level electron configuration of s^2p^2?
a. B
b. S
c. Ti
d. Si
e. Al

ANSWER: d

209. What is the electron configuration of Zn^{2+}?
a. $[Ar]4s^23d^{10}$
b. $[Ar]3d^{10}$
c. $[Ar]4s^23d^8$
d. $[Ar]4s^23d^{10}4p^2$
e. $[Ar]4s^13d^9$

ANSWER: b

210. What is the electron configuration for the highest-energy occupied sublevel of antimony?
a. $3d^{10}$

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b. $4p^4$

c. $4p^3$

d. $4s^2$

e. $3d^9$

ANSWER: c

211. Which group of elements has 6 valence electrons?

a. group 2 (2A)

b. group 4 (4A)

c. group 15 (5A)

d. group 16 (6A)

e. group 18 (8A)

ANSWER: d

212. Based on the periodic table, molybdenum's electron configuration is expected to be [Kr]$5s^2 4d^4$, but it is actually [Kr]$5s^1 4d^5$. What causes this to happen?

ANSWER: Half-filled *s* and *d* sublevels are slightly more stable than a full *s* orbital and partially filled *d* sublevel.

213. Based on the periodic table, silver's electron configuration is expected to be [Kr]$5s^2 4d^9$, but it is actually [Kr]$5s^1 4d^{10}$. What causes this to happen?

ANSWER: A half-filled *s* and a full *d* sublevel are doubly stabilized and more favorable than a full *s* orbital and a partially filled *d* sublevel.

214. Using the periodic table, chromium's electron configuration is expected to be [Ar]$4s^2 3d^4$, but it has been experimentally determined to have a different electron configuration. What is chromium's actual electron configuration? Why does it deviate from the expected electron configuration?

ANSWER: Chromium's actual electron configuration is [Ar]$4s^1 3d^5$. The half-filled *s* and *d* sublevels are slightly more stable than a full *s* orbital with a partially filled *d* sublevel.

215. Using the periodic table, copper's electron configuration is expected to be [Ar]$4s^2 3d^9$, whereas it has been experimentally determined to have a different electron configuration. What is copper's actual electron configuration? Why does it deviate from the expected electron configuration?

ANSWER: Copper's actual electron configuration is [Ar]$4s^1 3d^{10}$. A half-filled *s* and a full *d* sublevel are doubly stabilized and more favorable than a full *s* orbital and a partially filled *d* sublevel.

216. What are the electron configurations for Ge, Ge^{2+}, and Ge^{4+}?

ANSWER: Ge: [Ar]$4s^2 3d^{10} 4p^2$
Ge^{2+}: [Ar]$4s^2 3d^{10}$
Ge^{4+}: [Ar]$3d^{10}$

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217. What is the effective nuclear charge for a fluorine atom?
a. +9
b. +8
c. +7
d. +6
e. +2
ANSWER: c

218. Which element has the highest effective nuclear charge?
a. Mg
b. S
c. B
d. C
e. N
ANSWER: b

219. Which of the following elements has the largest atomic radius?
a. B
b. Bi
c. Ba
d. Br
e. Be
ANSWER: c

220. Which of the following elements has the smallest atomic radius?
a. Ne
b. S
c. Li
d. As
e. Sn
ANSWER: a

221. Which of the following isoelectronic ions has the largest radius?
a. Cl^-
b. S^{2-}
c. P^{3-}
d. K^+
e. Ca^{2+}
ANSWER: c

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222. Which element has the highest ionization energy?
a. Fe
b. S
c. Al
d. O
e. N
ANSWER: d

223. Which of the following equations represents the second ionization energy of oxygen?
a. $O(g) + 2e^- \rightarrow O^{2-}(g)$
b. $O^-(g) + e^- \rightarrow O^{2-}(g)$
c. $O^{2-}(g) + 2e^- \rightarrow O(g)$
d. $O(g) \rightarrow O^{2+}(g) + 2e^-$
e. $O^+(g) \rightarrow O^{2+}(g) + 2e^-$
ANSWER: e

224. What property is a measure of the energy change when an atom gains an electron?
a. ionization energy
b. effective nuclear charge
c. metallic character
d. electron affinity
e. nonmetallic character
ANSWER: d

225. The electron affinity of chlorine is –349 kJ/mol. What is the change in energy associated with 10.0 g of Cl reacting to produce Cl^-?
a. –109 kJ
b. –98.4 kJ
c. –56.9 kJ
d. –117 kJ
e. –72.3 kJ
ANSWER: b

226. Write the equations that represent the first and second ionization energies of sulfur.
ANSWER: first ionization energy: $S(g) \rightarrow S^+(g) + e^-$
second ionization energy: $S^+(g) \rightarrow S^{2+}(g) + e^-$

227. Rank the following elements in order of increasing atomic radius: Se, Ca, N, O, K.
ANSWER: O < N < Se < Ca < K

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228. Rank the following isoelectronic species in order of decreasing radius: Xe, Cs^+, Ba^{2+}, I^-, Te^{2-}.
ANSWER: $Te^{2-} > I^- > Xe > Cs^+ > Ba^{2+}$

229. What is the metallic character of an element? Describe the periodic trends for metallic character for periods and groups.
ANSWER: The metallic character of an element refers to whether or not its chemical and physical properties are associated with metals. Elements with high metallic character are typically good conductors of heat and electricity, shiny, malleable, and tend to lose electrons easily in chemical reactions. As you move across a period from right to left on the periodic table, the metallic character increases. As you move down a group, the metallic character also increases.

230. What charge would you expect on an ion of strontium?
a. +4
b. +2
c. +1
d. –1
e. –2
ANSWER: b

231. Which of the following anions has the most oxygen atoms?
a. perchlorate
b. bromate
c. chlorite
d. hypobromite
e. iodide
ANSWER: a

232. What is the formula for the nitrate ion?
a. NO_3^{2-}
b. NO_3^-
c. NO_4^-
d. NO_4^{2-}
e. N^{3-}
ANSWER: b

233. Which of the following metals commonly forms an ion with a +3 charge?
a. zinc
b. copper
c. magnesium
d. sodium

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e. aluminum

ANSWER: e

234. Based on its position in the periodic table, what charge would you expect an ion of phosphorus to have?

a. +2
b. +3
c. –3
d. –2
e. –1

ANSWER: c

235. Which of the following is the ferrous ion?

a. Fe^{3-}
b. Fe^{+}
c. Fe^{2+}
d. Fe^{3+}
e. Fe^{2-}

ANSWER: c

236. Which of the following does NOT commonly form a monatomic anion?

a. xenon
b. phosphorus
c. bromine
d. sulfur
e. nitrogen

ANSWER: a

237. What is the charge on the carbonate ion?

a. +1
b. –1
c. +2
d. –2
e. –3

ANSWER: d

238. Which polyatomic anion has the formula HCO_3^-?

ANSWER: The bicarbonate anion or the hydrogen carbonate anion.

239. What is the formula for the ammonium ion?

ANSWER: NH_4^+

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240. Which common polyatomic ion has a charge of –3?
ANSWER: phosphate, PO_4^{3-}

241. Based on its position in the periodic table, what would you expect the charge on an ion of iodine to be?
ANSWER: –1

242. What is the formula of an ionic compound made from iron(III) and fluoride ions?
a. FeF
b. Fe_3F
c. Fe_2F_3
d. FeF_3
e. Fe_3F_2
ANSWER: d

243. What is the formula for barium sulfate?
a. $BaSO_3$
b. $BaSO_4$
c. Ba_2SO_4
d. $Ba(SO_4)_2$
e. $Ba(SO_3)_2$
ANSWER: b

244. What is the name of the ionic compound with the formula FeO?
a. iron(II) oxide
b. iron oxide
c. iron(III) oxide
d. iron dioxide
e. iron peroxide
ANSWER: a

245. What is the formula of calcium phosphate?
a. Ca_3PO_4
b. $Ca_3(PO_4)_2$
c. $Ca_2(PO_4)_3$
d. $CaPO_4$
e. Ca_2PO_4
ANSWER: b

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246. What is the formula of cobalt(II) chloride hexahydrate?

a. $CuCl_2 \cdot 4H_2O$

b. $CoCl_2 \cdot 7H_2O$

c. $CaCl_2 \cdot 6H_2O$

d. $CuCl_2 \cdot 7H_2O$

e. $CoCl_2 \cdot 6H_2O$

ANSWER: e

247. What is the name of the hydrate $Ca(NO_3)_2\ 4H_2O$?

a. calcium dinitrate tetrahydrate

b. cadmium nitrate tetrahydrate

c. calcium nitrate tetrahydrate

d. calcium nitrate pentahydrate

e. cadmium nitrate hexahydrate

ANSWER: c

248. What is the formula for calcium sulfate?

a. $CaSO_4$

b. $CaSO_3$

c. $CaSO_2$

d. CaS

e. CaS_2

ANSWER: a

249. Two electrons are put close very to each other. The force they experience is _____

a. attractive and weak.

b. attractive and strong.

c. repulsive and weak.

d. repulsive and strong.

e. nothing.

ANSWER: d

250. To form a neutral solid the positive charge must be _____ the negative charge.

a. less than

b. greater than

c. equal to

d. far away from

e. none of the above

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ANSWER: c

251. What is the name of the ionic compound $Mn(ClO_4)_2$?
a. manganese chlorate
b. manganese(II) perchlorate
c. manganese(II) chloride
d. manganese(III) hypochlorite
e. manganese dichlorate
ANSWER: b

252. When two oppositely charged ions come close together, they are attracted and form what kind of bond?
ANSWER: an ionic bond

253. What is the name of the ionic compound Al_2O_3?
ANSWER: Aluminum oxide

254. We can calculate the force of attraction or repulsion between two charged particles using what law?
ANSWER: Coulomb's law

255. Predict the empirical formula of an ionic compound made from barium and iodide ions.
ANSWER: BaI_2

256. What is the formula of sodium phosphate?
ANSWER: Na_3PO_4

257. Which of the following compounds has at least one covalent bond?
a. NaCl
b. H_2O
c. KBr
d. $MgCl_2$
e. CaO
ANSWER: b

258. What is the formula for nitrogen trifluroride?
a. NF
b. N_3F
c. NF_2
d. NF_3
e. N_4F_3
ANSWER: d

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259. What is the name for the compound SF_6?
a. sulfur fluoride
b. sulfur hexafluorine
c. sulfur hexafluoride
d. monosulfur hexafluoride
e. hexasulfur fluoride
ANSWER: c

260. What type of bond forms when two pairs of electrons are shared?
a. single covalent bond
b. double covalent bond
c. triple covalent bond
d. ionic bond
e. metallic bond
ANSWER: b

261. What is the name of the compound CBr_4?
a. carbon tetrabromide
b. carbon bromide
c. monocarbon tetrabromide
d. carbide tetrabromide
e. carbon tetrabromine
ANSWER: a

262. What is the name of P_4O_{10}?
a. phosphorus oxide
b. tetraphosphorus decoxygen
c. tetraphosphorus decoxide
d. phosphide oxide
e. phosphorus decoxide
ANSWER: c

263. What is the formula of dinitrogen monoxide?
a. NO
b. NO_2
c. N_2O
d. N_2O_2
e. N_2O_4

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ANSWER: c

264. What is the formula for silicon dioxide?

a. SO_2
b. SiO_4
c. SO_4
d. Si_2O_4
e. SiO_2

ANSWER: e

265. Which of the following elements is NOT diatomic?

a. hydrogen
b. bromine
c. fluorine
d. nitrogen
e. helium

ANSWER: e

266. What is the name for $SiCl_4$?

a. silicon tetrachloride
b. silicon chloride
c. monosilicon chloride
d. monosilicon tetrachloride
e. tetrachloride silicon

ANSWER: a

267. What is the name of the covalent compound S_2O_4?

ANSWER: disulfur tetroxide

268. What is a covalent bond?

ANSWER: A covalent bond is a chemical bond where two electrons are shared between two atoms.

269. What is the formula for xenon hexafluoride?

ANSWER: XeF_6

270. What is the name for N_2S_5?

ANSWER: dinitrogen pentasulfide

271. What type of elements usually form covalent bonds?

ANSWER: nonmetals

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272. Ionic compounds form between what two types of atoms?
a. two metals
b. two nonmetals
c. a metal and a nonmetal
d. two noble gases
e. a solid and a liquid
ANSWER: c

273. Which of the following is NOT a characteristic property of ionic compounds?
a. high melting and boiling points
b. low melting and boiling points
c. high solubility in water
d. electrical conductivity in solution
e. usually solid at room temperature
ANSWER: b

274. Which of the following is typically TRUE for covalent compounds?
a. good conductors of electricity in solution
b. high melting and boiling points
c. highly soluble in water
d. low melting and boiling points
e. always solid at room temperature
ANSWER: d

275. Which of the following is an example of an ionic compound?
a. N_2O
b. KBr
c. H_2O
d. N_2
e. C_3H_8
ANSWER: b

276. Which of the following is an example of a covalent compound?
a. LiBr
b. MgO
c. H_2O
d. $MgCl_2$
e. NaF
ANSWER: c

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277. Which of the following compounds is an acid?

a. H_2

b. $CaCl_2$

c. K_2SO_4

d. NaNO3

e. H_2CO_3

ANSWER: e

278. What is the name of the acid H_2SO_3?

a. sulfurous acid

b. sulfuric acid

c. hydrosulfuric acid

d. dihydrogen sulfite

e. hydrosulfurous acid

ANSWER: a

279. What is the formula for perchloric acid?

a. HCl

b. HClO

c. $HClO_2$

d. $HClO_3$

e. $HClO_4$

ANSWER: e

280. An aqueous solution of an ionic compound is called _____.

a. a heterogeneous solution

b. a magnetic solution

c. an electrochemical solution

d. an electrolyte solution

e. a conducting solution

ANSWER: d

281. What does phosphoric acid ionize into when dissolved into water?

ANSWER: It will ionize into three hydrogen ions and one phosphate ion.

282. Based on its formula, would you expect $BaCO_3$ to be ionic or covalent?

ANSWER: Barium is a metal and the carbonate anion is made of nonmetals, which makes barium carbonate an ionic compound.

283. How do the melting points of ionic and covalent compounds differ?

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ANSWER: Ionic compounds tend to have higher melting points, and covalent compounds tend to have lower melting points.

284. How do the behaviors of ionic and covalent compounds differ in aqueous solution?

ANSWER: Soluble ionic compounds dissociate into their constituent ions, whereas covalent compounds remain as discrete molecules.

285. Would you expect an aqueous solution of copper(II) chloride to conduct electricity?

ANSWER: Yes, a solution of copper(II) chloride will conduct electricity as ionic compounds dissociate into their constituent ions, becoming strong electrolytes.

286. What does the empirical formula of a compound represent?

a. the actual number of atoms in a molecule
b. the simplest whole-number ratio of elements in a compound
c. the molecular weight of a compound
d. the ratio of isotopes in a molecule
e. the arrangement of atoms in a molecule

ANSWER: b

287. If a compound consists of 40% carbon, 6.7% hydrogen and 53.3% oxygen by mass, what is its empirical formula?

a. CHO
b. CH_2O
c. CH_3O
d. $C_3H_6O_2$
e. C_4H_8O

ANSWER: b

288. What is the molecular formula of a compound if its empirical formula is CH_2 and the molar mass is 56 g/mol?

a. CH_2
b. C_3H_6
c. C_2H_4
d. C_4H_8
e. C_5H_{10}

ANSWER: d

289. Mass spectrometry provides what information about a compound?

a. the percent composition
b. the empirical formula

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c. the empirical mass
d. the molecular mass
e. the atomic mass

ANSWER: d

290. Which of the following best describes combustion analysis?
a. analysis of products formed by burning a sample
b. the identification of elements through heating
c. analysis of metallic elements
d. separation of mixtures based on combustion products
e. measurement of bond energies

ANSWER: a

291. In combustion analysis, which of the following is measured to determine the amount of hydrogen in a compound?
a. carbon dioxide (CO_2)
b. hydrogen (H_2)
c. oxygen (O_2)
d. methane (CH_4)
e. water (H_2O)

ANSWER: e

292. If a compound contains 82.6% carbon and 17.4% hydrogen by mass, what is its empirical formula?
a. CH_3
b. C_2H_5
c. C_4H_5
d. C_4H_{12}
e. C_5H_8

ANSWER: b

293. Which of the following is TRUE about molecular formulas?
a. They always have a greater number of atoms than empirical formulas
b. They represent the simplest ratio of atoms in a compound.
c. They provide the exact number of each type of atom in a molecule.
d. They are the same as a structural formula.
e. They are always multiples of isotopic masses.

ANSWER: c

294. What is the empirical formula of $C_8H_8O_3$?

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a. $C_4H_4O_3$
b. $C_8H_8O_3$
c. $C_{16}H_{16}O_6$
d. $C_4H_4O_3$
e. None of the above

ANSWER: b

295. A compound has an empirical formula of CH_2 and a molecular mass of 97.8 g/mol, what is the molecular formula of this compound?

ANSWER: The mass of the CH_2 unit is 14.03 g/mol. Taking 97.8/14.03 gives a value of 6.97 ≈ 7, so the molecular formula would be C_7H_{14}.

296. What are the three components of a mass spectrometer?

ANSWER: The three main components of a mass spectrometer are: an ionizing chamber, an electric field, and a detector.

297. A compound was analyzed and determined to be 53.3% C, 11.2% H, and 35.5% O by mass. Further analysis by mass spectrometry determined the molecular weight to be 90.1 g/mol. What is the molecular formula for this compound?

ANSWER: $C_4H_{10}O_2$

298. An unknown compound was analyzed by combustion analysis and found to be 37.23% C, 7.81% H, and 54.96% Cl. What is the empirical formula of this compound?

ANSWER: C_2H_5Cl

299. What information is required to find the molecular formula of a compound?

ANSWER: We need the empirical formula and the molecular mass to find the molecular formula.

300. What is the purpose of elemental analysis?

a. to determine the molecular formula
b. to measure the molecular mass of a compound
c. to determine the percent composition of elements in a compound
d. to identify the empirical formula only
e. to separate elements from a mixture

ANSWER: c

301. Which set of coefficients would balance the following chemical equation?

$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

a. 1, 3, 2, 4
b. 2, 5, 6, 2
c. 1, 5, 3, 4

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d. 2, 10, 6, 8
e. 1, 7, 3, 4

ANSWER: c

302. Which of the following is TRUE about the products of a combustion of a hydrocarbon?
a. The products are always water and hydrogen.
b. The products are always water and carbon monoxide.
c. The products are always water and carbon dioxide.
d. The products are always hydrogen and carbon dioxide.
e. The products are always nitrogen and carbon dioxide.

ANSWER: c

303. What must be the same on both sides of a balanced chemical equation?
a. the number of molecules
b. the number of atoms of each element
c. the volume of gases
d. the total energy
e. the temperature

ANSWER: b

304. Which of the following represents a correctly balanced equation?
a. $N_2 + 3H_2 \rightarrow NH_3$
b. $N_2 + H_2 \rightarrow 2NH_3$
c. $N_2 + 2H_2 \rightarrow NH_3$
d. $N_2 + 3H_2 \rightarrow 2NH_3$
e. $2N_2 + 3H_2 \rightarrow NH_3$

ANSWER: d

305. In the equation $2Al + 3Cl_2 \rightarrow 2AlCl_3$, what is the ratio of chlorine molecules to aluminum chloride molecules?
a. 3:2
b. 1:1
c. 2:3
d. 1:2
e. 3:3

ANSWER: a

306. What is the coefficient for water when the following equation is balanced?
$Al(OH)_3 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + H_2O$
a. 1

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b. 2
c. 3
d. 4
e. 6

ANSWER: e

307. What is the coefficient for sodium hydroxide when the following equation is balanced?
$NaOH + H_3PO_4 \rightarrow Na_3PO_4 + H_2O$

a. 1
b. 2
c. 3
d. 4
e. 6

ANSWER: c

308. What is the best way to balance a combustion reaction?

a. adjusting only the hydrogen atoms
b. using water as a reactant
c. ensuring that the oxygen atoms are balanced first
d. balancing carbon atoms first
e. making sure the number of oxygen molecules is always even

ANSWER: d

309. Balance the chemical equation for the combustion of nonane.
$C_9H_{20} + O_2 \rightarrow CO_2 + H_2O$

ANSWER: $C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$

310. Why do we not change the subscripts when balancing chemical equations?

ANSWER: The subscripts tell us how many atoms are present in each molecule. If they are changed, the identity of the molecule has changed, and the chemical reaction is different.

311. Balance the following chemical equation.
$Zn + HCl \rightarrow H_2 + ZnCl_2$

ANSWER: $Zn + 2HCl \rightarrow H_2 + ZnCl_2$

312. Balance the reaction of dichlorine pentoxide with water to form chloric acid.
$Cl_2O_5 + H_2O \rightarrow HClO_3$

ANSWER: $Cl_2O_5 + H_2O \rightarrow 2HClO_3$

313. Which of the following reaction types is NOT an oxidation-reduction reaction?

a. metal-acid
b. metal displacement

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c. combustion
d. acid-base neutralization
e. metal-nonmetal

ANSWER: d

314. Which of the following is a synthesis reaction?
a. $2H_2 + O_2 \rightarrow 2H_2O$
b. $2H_2O \rightarrow 2H_2 + O_2$
c. $2NaCl \rightarrow 2Na + Cl_2$
d. $Cu + 2AgNO_3 \rightarrow 2Ag + Cu(NO_3)_2$
e. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

ANSWER: a

315. Which type of reaction is represented by $AB \rightarrow A + B$?
a. synthesis
b. decomposition
c. single-displacement
d. double-displacement
e. combustion

ANSWER: b

316. Which of the following is a single-displacement reaction?
a. $NaOH + HCl \rightarrow NaCl + H_2O$
b. $2Mg + O_2 \rightarrow 2MgO$
c. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
d. $2KClO_3 \rightarrow 2KCl + 3O_2$
e. $2C_3H_8 + 5O_2 \rightarrow 6CO_2 + 8H_2O$

ANSWER: c

317. Which element is oxidized in the following reaction?
$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$
a. aluminum
b. iron
c. oxygen
d. both aluminum and iron
e. This is not an oxidation-reduction reaction.

ANSWER: a

318. In a single-displacement reaction involving a metal and a nonmetal, which species is typically reduced?
a. the metal

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b. the nonmetal
c. both are reduced
d. neither is reduced
e. the product is reduced

ANSWER: b

319. When a metal reacts with an acid (H^+), what will the products be?
a. a cation and a metal
b. an anion and a metal
c. a cation and hydrogen gas
d. an anion and hydrogen gas
e. a metal and hydrogen gas

ANSWER: c

320. In a single-displacement reaction involving a metal and a nonmetal, which species is typically oxidized?
a. the metal
b. the nonmetal
c. both are reduced
d. neither is reduced
e. the product is reduced

ANSWER: a

321. Write a balanced equation that describes the combustion of calcium.
ANSWER: $2Ca + O_2 \rightarrow 2CaO$

322. What is the difference between a synthesis reaction and a decomposition reaction?
ANSWER: A synthesis reaction combines multiple elements into a single compound, while a decomposition reaction breaks down a compound into its constituent elements.

323. Describe the difference between a single-displacement reaction and a double-displacement reaction.
ANSWER: A single-displacement reaction is usually between a metal and an ionic compound, and is also a redox reaction, whereas a double-displacement reaction is the swapping of ions between two ionic compounds.

324. Write a balanced equation for the reaction of zinc with nitrogen.
ANSWER: $3Zn(s) + N_2(g) \rightarrow Zn_3N_2(s)$

325. What is the ionic equation when sodium sulfate is dissolved in water?
a. $Na(SO_4)_3(s) \rightarrow 2Na^+(aq) + 3SO_4^{2-}(aq)$
b. $Na_3SO_4(s) \rightarrow 3Na^+(aq) + SO_4^{2-}(aq)$
c. $Na(SO_4)_2(s) \rightarrow 2Na^+(aq) + 2SO_4^{2-}(aq)$

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d. $Na_2SO_4(s) \rightarrow 2Na^+(aq) + SO_4^{2-}(aq)$

e. $NaSO_4(s) \rightarrow Na^+(aq) + SO_4^{2-}(aq)$

ANSWER: d

326. What happens when ammonium chloride dissolves in water?

a. It remains a solid.

b. It dissociates into NH_4^+ and Cl^- ions.

c. It reacts with water to form HCl.

d. It decomposes into ammonia and chlorine gas.

e. It forms a solid.

ANSWER: b

327. What is the ionic equation when sodium sulfide is dissolved in water?

a. $Na_2S_2(s) \rightarrow 2Na^+(aq) + 2S^{2-}(aq)$

b. $NaS(s) \rightarrow Na^+(aq) + S^-(aq)$

c. $Na_2S(s) \rightarrow 2Na^+(aq) + S^{2-}(aq)$

d. $NaS(s) \rightarrow Na^{2+}(aq) + S^{2-}(aq)$

e. $NaS_2(s) \rightarrow Na^{2+}(aq) + 2S^-(aq)$

ANSWER: c

328. What is the ionic equation when aluminum sulfate is dissolved in water?

a. $Al_2(SO_4)_3(s) \rightarrow 2Al^{3+}(aq) + 3SO_4^{2-}(aq)$

b. $Al_3(SO_4)_2(s) \rightarrow 3Al^{2+}(aq) + 2SO_4^{3-}(aq)$

c. $AlSO_4(s) \rightarrow Al^{2+}(aq) + SO_4^{2-}(aq)$

d. $AlSO_4(s) \rightarrow Al^{3+}(aq) + SO_4^{3-}(aq)$

e. $Al(SO_4)_3(s) \rightarrow Al^{3+}(aq) + 3SO_4^-(aq)$

ANSWER: a

329. When potassium bicarbonate is dissolved in water, how many ions are produced?

a. 0

b. 1

c. 2

d. 3

e. 4

ANSWER: c

330. What is the ionic equation when barium iodide is dissolved in water?

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a. $BaI(s) \rightarrow Ba^{2+}(aq) + I^{2-}(aq)$

b. $BaI_2(s) \rightarrow Ba^{2+}(aq) + 2I^{-}(aq)$

c. $BaI_3(s) \rightarrow Ba^{3+}(aq) + 3I^{-}(aq)$

d. $BaI_2(s) \rightarrow 2Ba^{2+}(aq) + I^{-}(aq)$

e. $BaI(s) \rightarrow Ba^{+}(aq) + I^{-}(aq)$

ANSWER: b

331. What is the balanced ionic equation when solid ammonium bromide is dissolved in water?

a. $2NH_4Br(s) \rightarrow 2NH_4^{+}(aq) + 2Br^{-}(aq)$

b. $NH_3Br(s) \rightarrow NH_3^{+}(aq) + Br^{-}(aq)$

c. $NH_4Br_2(s) \rightarrow NH_4^{+}(aq) + 2Br^{-}(aq)$

d. $NH_4Br(s) \rightarrow NH_4^{+}(aq) + Br^{-}(aq)$

e. none of the above

ANSWER: d

332. What are electrolyte solutions?

a. All solutions where water is the solvent.

b. Solutions that have a net negative charge.

c. Solutions that have a net positive charge.

d. Solutions connected to an electrical circuit.

e. Solutions containing dissolved ions.

ANSWER: e

333. What is the ionic equation when solid calcium chloride is dissolved in water?

a. $CaCl(s) \rightarrow Ca^{+}(aq) + Cl^{-}(aq)$

b. $Ca_2Cl(s) \rightarrow 2Ca^{+}(aq) + Cl^{2-}(aq)$

c. $CaCl(s) \rightarrow Ca^{2+}(aq) + Cl^{2-}(aq)$

d. $CaCl_2(s) \rightarrow Ca^{2+}(aq) + 2Cl^{-}(aq)$

e. $CaCl_3(s) \rightarrow Ca^{3+}(aq) + 3Cl^{-}(aq)$

ANSWER: d

334. Write the ionic equation for the dissolution of $KC_2H_3O_2$ in water.

ANSWER: $KC_2H_3O_2(s) \rightarrow K^{+}(aq) + C_2H_3O_2^{-}(aq)$

335. Write the ionic equation for the dissolution of aluminum bromide in water.

ANSWER: $AlBr_3(s) \rightarrow Al^{3+}(aq) + 3Br^{-}(aq)$

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336. Write the molecular and ionic equations for the dissolution of calcium nitrate in water.

ANSWER: molecular: $Ca(NO_3)_2(s) \rightarrow Ca(NO_3)_2(aq)$
ionic: $Ca(NO_3)_2(s) \rightarrow Ca^{2+}(aq) + 2NO_3^-(aq)$

337. Which of the following compounds is soluble in water?

a. $AgCl$
b. PbI_2
c. $BaSO_4$
d. KNO_3
e. $MgCO_3$

ANSWER: d

338. Which of the following compounds is insoluble in water?

a. $Hg(C_2H_3O_2)_2$
b. $AgClO_4$
c. Li_2SO_3
d. $Ba(OH)_2$
e. $Cu_3(PO_4)_2$

ANSWER: e

339. A complete ionic equation shows _____

a. positive ions.
b. negative ions.
c. spectator ions.
d. precipitated species.
e. all of the above.

ANSWER: e

340. In which of the following aqueous combinations would NO precipitation reaction occur?

a. $LiCl + K_3PO_4$
b. $NaSO_4 + KNO_3$
c. $NH_4OH + PbNO_3$
d. $AgClO_4 + CaBr_2$
e. $Fe_2S_3 + Hg(C_2H_3O_2)_2$

ANSWER: b

341. In which of the following aqueous combinations would a precipitation reaction occur?

a. $LiCl + (NH_4)_2CO_3$

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b. $Na_2SO_4 + KNO_3$

c. $NaC_2H_3O_2 + CuSO_4$

d. $AgClO_4 + CaBr_2$

e. $ZnS + AlCl_3$

ANSWER: d

342. Which of the following compounds would cause a precipitate to form when added to a solution of Ba^{2+}?

a. NH_4OH

b. $NaC_2H_3O_2$

c. $MgBr_2$

d. Na_2SO_4

e. FeI_3

ANSWER: d

343. Which of the following will precipitate in an aqueous solution?

a. $Mg(C_2H_3O_2)_2$

b. NH_4ClO_4

c. LiI

d. KOH

e. $Ba_3(PO_4)_2$

ANSWER: e

344. When the temperature of an aqueous solution is increased from room temperature to just below boiling, the solubility of ionic compounds in the solution generally _____

a. increases greatly.

b. decreases greatly.

c. stays about the same.

d. is always constant for all solutes in aqueous solutions.

e. cannot determine without more information.

ANSWER: a

345. What species will precipitate when $BaCl_2$ and Na_2SO_4 are mixed?

ANSWER: $BaSO_4$

346. What species will precipitate when $ZnS(aq)$ and $K_3PO_4(aq)$ are mixed?

ANSWER: $Zn_3(PO_4)_2$

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347. Will a precipitate form when $CaCl_2$ is mixed with Fe_2S_3, and if so, what is the precipitate?
ANSWER: No, there will not be a precipitate formed. CaS and $FeCl_3$ are both soluble.

348. Will a precipitate be formed when $Hg(NO_3)_2$ is mixed with MgI_2, and if so, what is the precipitate?
ANSWER: Yes, the precipitate is HgI_2.

349. Identify the precipitate formed when $Mg(NO_3)_2$ reacts with K_3PO_4, and write the balanced net ionic equation for the reaction.
ANSWER: The precipitate is $Mg_3(PO_4)_2$.
$3Mg^{2+}(aq) + 2PO_4^{3-}(aq) \rightarrow Mg_3(PO_4)_2(s)$

350. When nitric acid reacts with potassium hydroxide, the products will be water and what?
a. KOH
b. $NaNO_3$
c. KNO_3
d. NaCl
e. HNO_3
ANSWER: c

351. What ions will be present in an aqueous solution of sodium hydroxide?
a. Na^+ and Cl^-
b. OH^- and Cl^-
c. H^+ and OH^-
d. Na^+ and OH^-
e. $Na^+ + H_2$
ANSWER: d

352. Which of the following is the net ionic equation for the neutralization of HCl and NaOH?
a. $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$
b. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
c. $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(aq)$
d. $Na^+(aq) + OH^-(aq) \rightarrow NaOH(aq)$
e. $H^+(aq) + Cl^-(aq) \rightarrow HCl(aq)$
ANSWER: b

353. When an acid reacts with a base, they form water and what other kind of compound?
a. a salt

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b. a gas
c. an acid
d. a base
e. It depends on what the acid and base are.

ANSWER: a

354. Which of the following is the net ionic equation for the neutralization of HNO_3 and KOH?
a. $HNO_3(aq) + KOH(aq) \rightarrow KNO_3(aq) + H_2O(l)$
b. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
c. $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(aq)$
d. $K^+(aq) + OH^-(aq) \rightarrow KOH(aq)$
e. $H^+(aq) + NO_3^-(aq) \rightarrow HNO_3(aq)$

ANSWER: b

355. Predict the products for the following reaction.
$H_3PO_4(aq) + Ba(OH)_2(aq) \rightarrow$
a. $Ba_3PO_4(s) + H_2O(l)$
b. $BaPO_4(s) + H_2O(l)$
c. $Ba_3(PO_4)_2(s) + H_2O(l)$
d. $Ba_3(PO_4)_2(s) + H_2O(aq)$
e. none of the above

ANSWER: c

356. When HI reacts with $Ba(OH)_2$, how many molecules of water are produced?
a. 0 H_2O
b. 1 H_2O
c. 2 H_2O
d. 4 H_2O
e. 8 H_2O

ANSWER: c

357. How many sodium hydroxide molecules are needed to form sodium phosphate when phosphoric acid reacts with sodium hydroxide?
a. 0 NaOH
b. 1 NaOH
c. 2 NaOH
d. 3 NaOH

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e. 6 NaOH

ANSWER: d

358. What is the driving force when an acid-base neutralization reaction occurs?

ANSWER: the formation of water

359. What is the net ionic equation of an acid-base neutralization reaction?

ANSWER: $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

360. Identify the products, and write the balanced molecular equation for the neutralization reaction between H_2SO_4 and KOH.

ANSWER: The products are $K_2SO_4(aq)$ and $H_2O(l)$. The balanced reaction is $H_2SO_4(aq) + 2KOH(aq) \rightarrow 2H_2O(l) + K_2SO_4(aq)$.

361. Identify the products, and write the balanced molecular equation for the acid-base neutralization reaction between $HClO_4$ and LiOH.

ANSWER: The products are $LiClO_4(aq)$ and $H_2O(l)$. The balanced reaction is $HClO_4(aq) + LiOH(aq) \rightarrow H_2O(l) + LiClO_4(aq)$.

362. What is a base?

ANSWER: A base is a substance that produces OH^- in aqueous solution.

363. According to the activity series, which of the following metals can displace hydrogen from an acid?

a. copper
b. zinc
c. silver
d. gold
e. platinum

ANSWER: b

364. Which of the following metals will react most strongly with water?

a. calcium
b. magnesium
c. zinc
d. potassium
e. copper

ANSWER: d

365. What happens when magnesium is placed in hydrochloric acid?

a. No reaction occurs.
b. Magnesium hydride and chlorine gas are formed.

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c. Water and magnesium hydroxide are formed.
d. Hydrogen gas and magnesium chloride are formed.
e. Magnesium oxide is formed.

ANSWER: d

366. Which of the following metals will NOT react with water at room temperature?
a. lithium
b. sodium
c. copper
d. calcium
e. potassium

ANSWER: c

367. Which of the following metals is hardest to oxidize?
a. silver
b. iron
c. copper
d. nickel
e. gold

ANSWER: e

368. Which group of metals is generally the most reactive?
a. alkali metals
b. alkaline earth metals
c. transition metals
d. metalloids
e. All metals have about the same reactivity.

ANSWER: a

369. Which of the following is TRUE about the activity series?
a. An element can reduce an ion above it on the activity series.
b. An ion can oxidize an element above it on the activity series.
c. An ion can reduce an element below it on the activity series.
d. An element can reduce an ion below it on the activity series.
e. Cannot tell without more information.

ANSWER: d

370. What is the balanced equation when barium reacts with steam?
a. $Ba(s) + H_2O(l) \rightarrow Ba(OH)_2(aq) + H_2(g)$
b. $Ba(s) + 2H_2O(g) \rightarrow Ba^{2+}(aq) + 2OH^-(aq) + H_2(g)$

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c. $Ba(s) + H_2O(g) \rightarrow Ba^{2+}(aq) + OH^-(aq) + H_2(g)$

d. $Ba(s) + 2H_2O(l) \rightarrow Ba^{2+}(aq) + OH^-(aq) + H_2(g)$

e. $Ba(s) + 2H_2O(l) \rightarrow Ba^{2+}(aq) + OH^-(aq)$

ANSWER: b

371. Based on the activity series, which of the following metals can reduce cobalt(II) to elemental cobalt?
a. nickel
b. tin
c. copper
d. lead
e. none of the above

ANSWER: e

372. Write the net ionic equation for the reaction of tin with silver nitrate.

ANSWER: $Sn(s) + 2Ag^+(aq) \rightarrow Sn^{2+}(aq) + 2Ag(s)$

373. Complete and balance the following reaction. If a reaction doesn't occur, write no reaction.
$Al + Ba(NO_3)_2 \rightarrow$

ANSWER: no reaction

374. Write the molecular, total, and net ionic equations for the reaction of Pb with $CuSO_4$.

ANSWER: molecular: $Pb(s) + CuSO_4(aq) \rightarrow PbSO_4(aq) + Cu(s)$
ionic: $Pb(s) + Cu^{2+}(aq) + SO_4^{2-}(aq) \rightarrow Pb^{2+}(aq) + SO_4^{2-}(aq) + Cu(s)$
net ionic: $Pb(s) + Cu^{2+}(aq) \rightarrow Pb^{2+}(aq) + Cu(s)$

375. Complete and balance the following reaction.
$Ca + H_2SO_4 \rightarrow$

ANSWER: $Ca + H_2SO_4 \rightarrow CaSO_4 + H_2$

376. What is the mass of 2.50 moles of sodium chloride?
a. 80.7 g
b. 58.5 g
c. 117 g
d. 146 g
e. 169 g

ANSWER: d

377. How many moles are in 24 g of O_2 gas?
a. 0.50 moles

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b. 0.75 moles
c. 1.0 mole
d. 1.5 moles
e. 2.0 moles

ANSWER: b

378. How many molecules of nitrogen are in 0.120 moles of nitrogen gas?

a. 7.23×10^{22} molecules
b. 1.45×10^{23} molecules
c. 6.02×10^{23} molecules
d. 7.23×10^{23} molecules
e. 3.61×10^{22} molecules

ANSWER: a

379. A sample of water has a mass of 33.28 g. How many water molecules are in this sample?

a. 1.112×10^{23} molecules
b. 2.004×10^{24} molecules
c. 1.112×10^{24} molecules
d. 3.61×10^{26} molecules
e. 1.112×10^{25} molecules

ANSWER: d

380. A sample of acetone contains 4.59×10^{23} molecules of acetone. What is the mass of this acetone sample? The molar mass of acetone is 58.1 g/mol.

a. 4.43 g
b. 23.7 g
c. 44.3 g
d. 58.1 g
e. 0.0131 g

ANSWER: c

381. What is the mass of 24.20 moles of carbon dioxide? The molar mass of CO_2 is 44.01 g/mol.

a. 978.0 g
b. 1065 g
c. 1068 g
d. 1152 g
e. 1357 g

ANSWER: b

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382. How many moles of Br are in 3.84 moles of $MgBr_2$?
a. 2.00 moles
b. 3.00 moles
c. 3.84 moles
d. 7.68 moles
e. 11.5 moles
ANSWER: d

383. A sample contains 2.5×10^{24} atoms of silver (Ag). How many moles of silver are in the sample?
a. 0.42 moles
b. 1.2 moles
c. 1.8 moles
d. 2.4 moles
e. 4.2 moles
ANSWER: d

384. How many sulfur atoms are in a 53.2 g sample of CS_2?
a. 7.88×10^{23} atoms
b. 8.42×10^{24} atoms
c. 1.53×10^{24} atoms
d. 4.21×10^{23} atoms
e. 8.42×10^{23} atoms
ANSWER: e

385. What is the mass of 9.03×10^{23} Ar atoms?
a. 59.9 g
b. 39.7 g
c. 17.3 g
d. 6.00 g
e. 120 g
ANSWER: a

386. How many molecules are in a 54.9 g sample of carbon monoxide (CO)?
ANSWER: 1.18×10^{24} molecules

387. How many moles of $CuSO_4$ are in a 135.61 g sample?
ANSWER: 0.84963 mol

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388. Hydrochloric acid (HCl) has a molar mass of 36.46 g/mol. How many molecules are in 81.00 g of HCl?
ANSWER: 1.338×10^{24} molecules

389. How many fluorine atoms are in 44.31 g of BF_3?
ANSWER: 1.181×10^{24} F atoms

390. What is the mass of 1.99×10^{25} $GeCl_2$ molecules?
ANSWER: 4740 g

391. How many moles of HNO_3 can be produced from 5.0 moles of NO_2?
$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$

a. 2.5 moles
b. 3.3 moles
c. 5.0 moles
d. 6.7 moles
e. 10 moles

ANSWER: b

392. Calcium carbonate can decompose according to the following reaction. How many grams of CaO are formed from the decomposition of 35.2 g of $CaCO_3$?
$CaCO_3 \rightarrow CO_2 + CaO$

a. 15.8 g
b. 21.5 g
c. 25.3 g
d. 19.7 g
e. 30.6 g

ANSWER: d

393. If 62.4 g of $BaSO_4$ is produced from the following reaction, what mass of NaCl is also formed?
$Na_2SO_4 + BaCl_2 \rightarrow 2NaCl + BaSO_4$

a. 15.7 g
b. 31.2 g
c. 45.6 g
d. 48.9 g
e. 62.6 g

ANSWER: b

394. Ammonium nitrate decomposes via the following reaction. If 10 g of ammonium nitrate decomposes, what mass of water is produced?
$2NH_4NO_3 \rightarrow 2N_2 + O_2 + 4H_2O$

a. 2.0 g

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b. 3.6 g
c. 4.5 g
d. 5.8 g
e. 7.2 g

ANSWER: c

395. The combustion of butane is shown in the following reaction. If 3.65 g of butane is combusted, what mass of carbon dioxide is produced?

$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

a. 8.52 g
b. 9.76 g
c. 22.1 g
d. 11.1 g
e. 5.70 g

ANSWER: d

396. What is the first step when calculating the mass of a product produced from a given mass of a reactant?

a. Use the molar mass of the product to convert from moles to grams.
b. Use the coefficients in the balanced equation to convert from moles of reactant to moles of product.
c. Use the molar mass of the reactant to convert from grams to moles.
d. Use the coefficients in the balanced equation to convert from moles of product to moles of reactant.
e. Use the molar mass of the product to convert from grams to moles.

ANSWER: c

397. Sulfur hexafluoride is formed in the following reaction. How many moles of SF_6 can be formed from 41.9 g of F_2?

$S + 3F_2 \rightarrow SF_6$

a. 1.10 mol SF_6
b. 0.368 mol SF_6
c. 0.550 mol SF_6
d. 0.730 mol SF_6
e. 3.31 mol SF_6

ANSWER: b

398. Calcium hydroxide and phosphoric acid react according to the following acid-base reaction. What mass of water is produced from 15.2 g of H_3PO_4?

$3Ca(OH)_2 + 2H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6H_2O$

a. 5.51 g
b. 16.8 g

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c. 8.38 g
d. 2.80 g
e. 9.33 g

ANSWER: c

399. What mass of copper is produced when 33.7 g of iron reacts with excess Cu_2SO_4?
$Fe + Cu_2SO_4 \rightarrow 2Cu + FeSO_4$
a. 50.9 g
b. 63.5 g
c. 88.5 g
d. 76.7 g
e. 103 g

ANSWER: d

400. What mass of $Pb(NO_3)_2$ should be used to produce 100 g of KNO_3 through the following reaction?
$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$
a. 90.3 g
b. 328 g
c. 100 g
d. 81.9 g
e. 164 g

ANSWER: e

401. If 3 moles of C_6H_{12} are combusted in the following reaction, how many moles of water are produced?
$C_6H_{12} + 9O_2 \rightarrow 6CO_2 + 6H_2O$
ANSWER: 18 moles

402. Elemental magnesium reacts with hydrochloric acid according to the following reaction.
$Mg + 2HCl \rightarrow MgCl_2 + H_2$
If a 5.00 g piece of Mg is added to a beaker containing HCl, what mass of $MgCl_2$ is produced?
ANSWER: 19.6 g

403. When heated, potassium chlorate decomposes according to the following reaction.
$2KClO_3 \rightarrow 2KCl + 3O_2$
How many grams of $KClO_3$ were heated if 0.11 moles of O_2 are produced?
ANSWER: 9.0 g

404. What mass of K_3PO_4 is produced when 47.2 g of KOH is reacted with excess H_3PO_4?
$H_3PO_4 + 3KOH \rightarrow K_3PO_4 + 3H_2O$
ANSWER: 59.5 g

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405. Phosphorus and chlorine react according to the following reaction.
$P_4 + 10Cl_2 \rightarrow 4PCl_5$
What mass of phosphorus is needed to produce 45.4 g of PCl_5?
ANSWER: 6.75 g

406. Cesium and bromine react to form cesium bromide according to the following equation. If 3 moles of Cs combine with 2 moles of Br_2, how many moles of CsBr are formed?
$2Cs + Br_2 \rightarrow 2CsBr$
a. 3 moles
b. 2 moles
c. 1.5 moles
d. 7 moles
e. 4 moles
ANSWER: a

407. Sodium and chlorine react to form sodium chloride according to the following equation. If 3 moles of Na combine with 2 moles of Cl_2, how many moles of NaCl are formed?
$2Na + Cl_2 \rightarrow 2NaCl$
a. 3 moles
b. 2 moles
c. 1 mole
d. 6 moles
e. 4 moles
ANSWER: e

408. Propane (C_3H_8) undergoes the following combustion reaction. If 15 g of propane is combusted with 15 g of oxygen, what mass of water is produced?
$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
a. 24.5 g
b. 6.12 g
c. 3.38 g
d. 10.6 g
e. 6.76 g
ANSWER: e

409. Cl_2 reacts with NaBr according to the following reaction. If 2.04 g of NaBr react with 1.43 g of Cl_2, what mass of Br_2 is produced?
$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$
a. 0.790 g

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b. 1.02 g
c. 1.58 g
d. 2.04 g
e. 3.22 g

ANSWER: c

410. What is the limiting reagent when 1.5 moles of carbonic acid are added to 2.0 moles of NaOH? How many moles of sodium carbonate are formed in this reaction?

$H_2CO_3 + 2NaOH \rightarrow Na_2CO_3 + 2H_2O$

a. NaOH; 1.0 mol Na_2CO_3
b. NaOH; 1.5 mol Na_2CO_3
c. NaOH; 3.0 mol Na_2CO_3
d. H_2CO_3; 1.0 mol Na_2CO_3
e. H_2CO_3; 1.5 mol Na_2CO_3

ANSWER: a

411. When heated, iron(III)oxide reacts with carbon monoxide according to the following equation. If 37.0 g of Fe_2O_3 reacts with 18.0 g of CO, what mass of iron is produced?

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

a. 25.9 g
b. 18.5 g
c. 20.5 g
d. 23.9 g
e. 26.3 g

ANSWER: d

412. Acetylene reacts with oxygen according to the following equation. If 1.5 moles of acetylene react with 3.0 moles of oxygen, what reactant is left over and in what amount?

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

a. acetylene; 0.30 moles
b. acetylene; 0.50 moles
c. acetylene; 3.0 moles
d. oxygen; 3.0 moles
e. oxygen; 1.5 moles

ANSWER: a

413. Titanium(IV) oxide is produced by the following reaction. If 100 g of $FeTiO_3$ reacts with 55.0 g of H_2SO_4, what reactant is left over and in what amount?

$FeTiO_3 + H_2SO_4 \rightarrow TiO_2 + FeSO_4 + H_2O$

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a. 29.7 g $FeTiO_3$
b. 14.9 g $FeTiO_3$
c. 6.54 g H_2SO_4
d. 13.3 g H_2SO_4
e. Neither reactant is in excess.

ANSWER: b

414. Carbon dioxide reacts with barium oxide to form barium carbonate, $BaCO_3$. If 0.230 moles of CO_2 react with 0.870 moles of BaO, what is the limiting reagent and how much barium carbonate is produced?

a. CO_2; 22.7 g
b. CO_2; 45.4 g
c. BaO; 45.4 g
d. BaO; 90.8 g
e. BaO; 22.7 g

ANSWER: b

415. In the process of purifying nickel, the following reaction occurs. If 0.790 moles of Ni reacts with 2.31 moles of CO, what mass of $Ni(CO)_4$ is produced?

$Ni + 4CO \rightarrow Ni(CO)_4$

a. 135 g
b. 39.4 g
c. 58.7 g
d. 98.6 g
e. 171 g

ANSWER: d

416. If 3.44 moles of H_2S reacts with 1.54 moles of SO_2, what is the limiting reagent and how many moles of sulfur are produced?

$2H_2S + SO_2 \rightarrow 3S + 2H_2O$

ANSWER: SO_2 is the limiting reagent and 4.62 moles of S are produced.

417. Aluminum reacts with sulfuric acid via the following reaction.

$2Al + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 3H_2$

If 3.20 g of aluminum reacts with 17.1 g of sulfuric acid, what is the limiting reagent and what mass of aluminum sulfate is produced?

ANSWER: Sulfuric acid is the limiting reagent and 19.9 g of aluminum sulfate are produced.

418. Barium chloride reacts with sodium sulfate via the following reaction.

$BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$

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If 32.5 g of $BaCl_2$ reacts with 32.0 g of Na_2SO_4, which reactant is in excess and how much of the reactant is left after the reaction goes to completion?

ANSWER: Na_2SO_4 is in excess and there is 9.8 g of it remaining after the reaction goes to completion.

419. If 24.97 g of $Na_2S_2O_3$ reacts with 17.90 g of I_2, what is the limiting reagent and what mass of NaI is produced?

$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$

ANSWER: Iodine is the limiting reagent and 21.14 g of NaI are produced.

420. If 15.5 g of $FeCl_3$ react with 8.2 g of H_2S, what is the limiting reagent and what mass of sulfur is produced?

$2FeCl_3 + H_2S \rightarrow 2FeCl_2 + 2HCl + S$

ANSWER: $FeCl_3$ is the limiting reagent and 1.5 g of S are produced.

421. The major component of a solution is called the _____

a. solvent.
b. solute.
c. solution.
d. aqueous fraction.
e. major fraction.

ANSWER: a

422. What is the definition of molarity?

a. moles of solute per kilogram of solvent
b. moles of solute per liter of solution
c. moles of solute per kilogram of solution
d. moles of solute per liter of solvent
e. grams of solute per milliliter of solution

ANSWER: b

423. How many moles of $CuSO_4$ are in 500 mL of a 2.1 M copper(II) sulfate solution?

a. 4.2 moles
b. 2.1 moles
c. 1.1 moles
d. 0.52 moles
e. 0.25 moles

ANSWER: c

424. How many grams of glucose ($C_6H_{12}O_6$) are needed to prepare 250 mL of a 0.500 M glucose solution?

a. 90.1 g

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b. 180 g
c. 45.0 g
d. 225 g
e. 22.5 g

ANSWER: e

425. What is the molarity of a solution prepared by dissolving 37.2 g of KOH in enough water to make 0.500 L of solution?

a. 0.133 M
b. 0.660 M
c. 1.33 M
d. 3.32 M
e. None of the above.

ANSWER: c

426. What is the last step when making a solution using a volumetric flask?

a. Add the solid solute.
b. Partially fill the flask with solvent.
c. Add solvent in an amount equal to the final volume of the solution.
d. Dilute the solution to the mark on the flask with solvent.
e. Dilute the solution to the top of the flask with solvent.

ANSWER: d

427. When diluting a solution with additional solvent, the amount of moles of solute in the dilute solution _____

a. is greater than the amount of moles of solute in the original solution.
b. is less than the amount of moles of solute in the original solution.
c. is the same as the amount of moles of solute in the original solution.
d. relative to the original solution cannot be determined without more information.
e. relative to the original solution depends on the solute.

ANSWER: c

428. What volume of a 3.00 M KNO_3 solution would you need to make 250 mL of a 1.43 M solution?

a. 15.1 mL
b. 83.3 mL
c. 65.6 mL
d. 42.1 mL
e. 119 mL

ANSWER: e

429. Which of the following should be used for the gravimetric analysis of OH^-?

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a. Mg^{2+}
b. Ba^{2+}
c. Li^{+}
d. Zn^{2+}
e. K^{+}

ANSWER: d

430. How many grams of Cu_2SO_4 are needed to make 100 mL of a 0.300 M solution of copper(I) sulfate?
a. 6.69 g
b. 22.3 g
c. 13.4 g
d. 0.670 g
e. 4.46 g

ANSWER: a

431. How many grams of ammonium cyanide (NH_4CN) are needed to make 1.5 L of a 3.0 M solution?
ANSWER: 2.0×10^2 g

432. How many milliliters of a 3.40 M K_2SO_3 solution are needed to make 100 mL of a 0.500 M solution?
ANSWER: 14.7 mL

433. A 1.5 L solution contains 51.6 g of $Mg(C_2H_3O_2)_2$. What is the molarity of the solution?
ANSWER: 0.24 M

434. Cobalt(II) chloride hexahydrate ($CoCl_2\cdot6H_2O$) turns from pink to blue when dehydrated. If you want to make 250 mL of a 0.33 M cobalt(II) chloride hexahydrate solution, how many grams would you need?
ANSWER: 19.6 g

435. 300.0 mL of a 0.600 M aluminum chloride ($AlCl_3$) solution are mixed with 400.0 mL of a 0.800 M sodium hydroxide (NaOH) solution. Which reactant is the limiting reagent and how many grams of aluminum hydroxide are formed?
$AlCl_3(aq) + 3NaOH(aq) \rightarrow Al(OH)_3(s) + 3NaCl(aq)$
ANSWER: NaOH is the limiting reagent and 8.32 g of $Al(OH)_3$ are produced.

436. The actual yield of a reaction is _____
a. the experimentally measured amount of product formed.
b. the maximum amount of product predicted.
c. the amount of reactants used up.
d. always equal to the theoretical yield.

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e. the reactant left unreacted.

ANSWER: a

437. The theoretical yield of a reaction is _____

a. the experimentally measured amount of product formed.
b. the maximum amount of product predicted.
c. the amount of reactants used up.
d. always equal to the actual yield.
e. the reactant left unreacted.

ANSWER: b

438. A reaction has a theoretical yield of 22.5 g and a percent yield of 73.1%. What is the actual yield?

a. 1.64 g
b. 16.4 g
c. 8.20 g
d. 22.5 g
e. 15.8 g

ANSWER: b

439. If the theoretical yield of a product is 15 g, but only 12 g is obtained experimentally, what is the percent yield?

a. 67%
b. 75%
c. 80%
d. 90%
e. 100%

ANSWER: c

440. If a chemist calculates a percent yield of 120%, what is the most likely explanation?

a. The reaction was incomplete.
b. The theoretical yield was overestimated.
c. The reactants were impure.
d. The reaction was carried out in perfect conditions.
e. The actual yield was measured incorrectly.

ANSWER: e

441. Calcium nitrate reacts with sodium phosphate according to the following reaction.

$3Ca(NO_3)_2(aq) + 2Na_3PO_4(aq) \rightarrow Ca_3(PO_4)_2(s) + 6NaNO_3(aq)$

If 50.0 g of $Ca(NO_3)_2$ reacts with 40.0 g of Na_3PO_4, what is the theoretical yield of $Ca_3(PO_4)_2$?

a. 40.0 g
b. 63.0 g

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c. 31.5 g
d. 25.9 g
e. 3.15 g

ANSWER: c

442. Sodium bicarbonate decomposes upon heating to form sodium carbonate, carbon dioxide, and water.
$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$
If 12.0 g of $NaHCO_3$ is heated, what is the theoretical yield of sodium carbonate?

a. 3.80 g
b. 7.57 g
c. 15.1 g
d. 17.9 g
e. 22.8 g

ANSWER: b

443. Silver nitrate reacts with potassium bromide to form silver bromide.
$AgNO_3(aq) + KBr(aq) \rightarrow AgBr(s) + KNO_3(aq)$
If 8.71 g of $AgNO_3$ reacts with excess KBr, what is the percent yield if 38.0 g of AgBr are produced?

a. 8.30%
b. 12.7%
c. 21.6%
d. 25.3%
e. 28.0%

ANSWER: d

444. Barium chloride reacts with sodium carbonate to form barium carbonate.
$BaCl_2(aq) + Na_2CO_3(aq) \rightarrow BaCO_3(s) + 2NaCl(aq)$
If 100 mL of 0.30 M $BaCl_2$ react with excess sodium carbonate, what is the theoretical yield of $BaCO_3$?

a. 2.4 g
b. 2.9 g
c. 5.9 g
d. 6.5 g
e. 12 g

ANSWER: c

445. Xenon tetrafluoride is formed by reacting xenon with fluorine.
$Xe + 2F_2 \rightarrow XeF_4$
If the theoretical yield of XeF_4 is 55.6 g, what is the percent yield if the actual yield is 22.1 g?

a. 4.00%
b. 13.2%

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c. 19.8%
d. 39.7%
e. 43.8%

ANSWER: d

446. A student conducts a reaction and the actual amount of product obtained is 3.23 g. If the theoretical yield is 8.99 g, what is the percent yield for this reaction?
ANSWER: 35.9%

447. A factory that produces food flavorings in bulk makes a particular product with a percent yield of 86.30%. If the theoretical yield of a typical batch is 4.55 kg, what is the actual yield of a typical batch?
ANSWER: 3.93 kg

448. A common substitution reaction has a percent yield of 34.3%. If the actual yield from the reaction is 4.20 g, what is the theoretical yield of the reaction?
ANSWER: 12.2 g

449. Potassium chlorate decomposes according to the following reaction.
$2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$
What is the percent yield if 15 g of O_2 are actually produced, but the reaction can theoretically produce 19.7 g of O_2?
ANSWER: 76%

450. Magnesium reacts with hydrochloric acid according to the following reaction.
$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(s) + H_2(g)$
If 2.00 g of Mg reacts with a solution containing 0.300 moles of HCl, what is the theoretical yield of $MgCl_2$ in grams for this reaction?
ANSWER: 7.84 g

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