CP Chem Final Review 1

Matching

Match each item with the correct statement below.

a. representative particle
b. mole
c. Avogadro's number
d. percent composition
e. standard temperature and pressure
f. empirical formula

____ 1. the number of representative particles of a substance present in 1 mole of that substance
____ 2. an atom, an ion, or a molecule, depending upon the way a substance commonly exists
____ 3. the SI unit used to measure amount of substance
____ 4. 0°C and 1 atm
____ 5. the percent by mass of each element in a compound
____ 6. the smallest whole number ratio of the atoms in a compound

Match each item with the correct statement below.

a. melting point
b. boiling point
c. sublimation
d. evaporation
e. vaporization
f. normal boiling point

____ 7. vaporization at the surface of a liquid that is not boiling
____ 8. the conversion of a liquid to a gas below the boiling point
____ 9. the temperature at which the vapor pressure of a liquid is equal to the external pressure
____ 10. the temperature at which the vapor pressure of a liquid is equal to 1 atmosphere
____ 11. the temperature at which a solid changes into a liquid
____ 12. the change of a solid directly to a vapor

Match each item with the correct statement below.

a. kinetic theory
b. atmospheric pressure
c. vapor pressure
d. barometer
e. kinetic energy

____ 13. All matter consists of tiny particles that are in constant motion.
____ 14. the energy an object has due to its motion
____ 15. a device used to measure atmospheric pressure
____ 16. the pressure resulting from the collision of atoms and molecules with objects
____ 17. a measure of the force exerted by a gas above a liquid

Match each item with the correct statement below.

a. Boyle's law
b. Charles's law
c. Dalton's law
d. Graham's law
e. Gay-Lussac's law
f. ideal gas law

____ 18. For a given mass of gas at constant temperature, the volume of the gas varies inversely with pressure.
____ 19. The volume of a fixed mass of gas is directly proportional to its Kelvin temperature, if the pressure is kept constant.
____ 20. The pressure of a gas is directly proportional to its Kelvin temperature if the volume is kept constant.
____ 21. $P \times V = n \times R \times T$
____ 22. At constant volume and temperature, the total pressure exerted by a mixture of gases is equal to the sum of the partial pressures of the component gases.
____ 23. The rate at which a gas will effuse is inversely proportional to the square root of the gas's molar mass.

Match each item with the correct statement below.

a. effusion
b. compressibility
c. diffusion
d. partial pressure

____ 24. a measure of how much the volume of matter decreases under pressure
____ 25. the pressure exerted by a gas in a mixture
____ 26. the escape of gas through a small hole in a container
____ 27. tendency of molecules to move to regions of lower concentration

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

____ 28. The diameter of a carbon atom is 0.000 000 000 154 m. What is this number expressed in scientific notation?
a. 1.54×10^{12} m
b. 1.54×10^{-12} m
c. 1.54×10^{10} m
d. 1.54×10^{-10} m

____ 29. The expression of 5008 km in scientific notation is ____.
a. 5.008×10^{3} km
b. 50.08×10^{2} km
c. 5.008×10^{-3} km
d. 5.008×10^{-4} km

____ 30. What is the result of multiplying 2.5×10^{10} by 3.5×10^{-7} ?
a. 8.75×10^{-3}
b. 8.75×10^{17}
c. 8.75×10^{3}
d. 8.75×10^{-17}

____ 31. What is the result of adding 2.5×10^{3} and 3.5×10^{2} ?
a. 2.9×10^{5}
b. 6.0×10^{5}
c. 2.9×10^{4}
d. 6.0×10^{3}

____ 32. The closeness of a measurement to its true value is a measure of its ____.
a. precision
b. accuracy
c. reproducibility
d. usefulness

____ 33. Which of the following measurements contains two significant figures?
a. 0.004 00 L
b. 0.004 04 L
c. 0.000 44 L
d. 0.004 40 L

____ 34. When a test instrument is calibrated, does its accuracy, precision, or reliability improve?
a. precision
b. accuracy
c. reliability
d. all of the above

____ 35. Which of the following measurements (of different masses) is the most accurate?
a. 3.1000 g
b. 3.100 00 g
c. 3.122 22 g
d. 3.000 000 g

____ 36. Which group of measurements is the most precise? (Each group of measurements is for a different object.)
a. 2 g, 3 g, 4 g
b. 2.0 g, 3.0 g, 4.0 g
c. 2 g, 2.5 g, 3 g
d. 1 g, 3 g, 5 g

____ 37. Three different people weigh a standard mass of 2.00 g on the same balance. Each person obtains a reading of 7.32 g for the mass of the standard. These results imply that the balance that was used is ____.

a. accurate
b. precise
c. accurate and precise
d. neither accurate nor precise

____ 38. Which of the following measurements is expressed to three significant figures?

a. 0.007 m
b. 7077 mg
c. 7.30×10^{-7} km
d. 0.070 mm

____ 39. In the measurement 0.503 L, which digit is the estimated digit?

a. 5
b. the 0 immediately to the left of the 3
c. 3
d. the 0 to the left of the decimal point

____ 40. How many significant figures are in the measurement 40,500 mg?

a. two
b. three
c. four
d. five

____ 41. Express the product of 2.2 mm and 5.00 mm using the correct number of significant digits.

a. 10 mm^2
b. 11 mm^2
c. 11.0 mm^2
d. 11.00 mm^2

____ 42. What is the measurement 111.009 mm rounded off to four significant digits?

a. 111 mm
b. 111.0 mm
c. 111.01 mm
d. 110 mm

____ 43. Express the product of 4.0×10^{-2} m and 8.1×10^{2} m using the correct number of significant digits.

a. 3×10^{1}
b. 3.0×10^{1}
c. 3.2×10^{1}
d. 3.24×10^{1}

____ 44. When multiplying and dividing measured quantities, the number of significant figures in the result should be equal to the number of significant figures in ____.

a. all of the measurements
b. the least and most precise measurements
c. the most precise measurement
d. the least precise measurement

____ 45. What quantity is represented by the metric system prefix *deci-*?

a. 1000
b. 100
c. 0.1
d. 0.01

____ 46. What is the metric system prefix for the quantity 0.000 001?

a. *centi-*
b. *deci-*
c. *kilo-*
d. *micro-*

____ 47. The chief advantage of the metric system over other systems of measurement is that it ____.

a. has more units
b. is in multiples of 10
c. is in French
d. is derived from nature itself

____ 48. Which of the following volumes is the smallest?

a. one microliter
b. one liter
c. one milliliter
d. one deciliter

____ 49. What is the SI unit of mass?

a. liter
b. joule
c. gram
d. kilogram

____ 50. What is the temperature of absolute zero measured in °C?
a. –373°C
b. –273°C
c. –173°C
d. –73°C

____ 51. Which temperature scale has no negative temperatures?
a. Celsius
b. Fahrenheit
c. Joule
d. Kelvin

____ 52. What is the boiling point of water in kelvins?
a. 0 K
b. 100 K
c. 273 K
d. 373 K

____ 53. The weight of an object ____.
a. is the same as its mass
b. depends on its location
c. is not affected by gravity
d. is always the same

____ 54. What is the temperature –34°C expressed in kelvins?
a. 139 K
b. 207 K
c. 239 K
d. 339 K

____ 55. If the temperature changes by 100 K, by how much does it change in °C?
a. 0°C
b. 37°C
c. 100°C
d. 273°C

Commonly Used Metric Prefixes

Prefix	Meaning	Factor
mega (M)	1 million times larger than the unit it precedes	10^{6}
kilo (k)	1000 times larger than the unit it precedes	10^{3}
deci (d)	10 times smaller than the unit it precedes	10^{-1}
centi (c)	100 times smaller than the unit it precedes	10^{-2}
milli (m)	1000 times smaller than the unit it precedes	10^{-3}
micro (μ)	1 million times smaller than the unit it precedes	10^{-6}
nano (n)	1000 million times smaller than the unit it precedes	10^{-9}
pico (p)	1 trillion times smaller than the unit it precedes	10^{-12}

____ 56. What is the quantity 0.0075 meters expressed in centimeters? Use the table above to help you.
a. 0.075 cm
b. 0.75 cm
c. 7.5 cm
d. 70.5 cm

____ 57. What is the quantity 7896 millimeters expressed in meters? Use the table above to help you.
a. 7.896 m
b. 78.96 m
c. 789.6 m
d. 789,600 m

____ 58. What is the quantity 987 milligrams expressed in grams? Use the table above to help you.
a. 0.000 987 g
b. 0.987 g
c. 9.87 g
d. 98,700 g

____ 59. Which of the following equalities is NOT correct? Use the table above to help you.
a. 100 cg = 1 g
b. 1000 mm = 1 m
c. $1\ cm^3 = 1\ mL$
d. 10 kg = 1 g

____ 60. The quantity 44 liters expressed in cubic meters is ____.
a. $0.000\ 044\ m^3$
b. $440\ 000\ m^3$
c. $0.44\ m^3$
d. $0.044\ m^3$

____ 61. Density is found by dividing ____.
a. mass by volume
b. volume by mass
c. mass by area
d. area by mass

____ 62. What is the density of an object having a mass of 8.0 g and a volume of 25 cm^3?
a. 0.32 g/cm^3
b. 2.0 g/cm^3
c. 3.1 g/cm^3
d. 200 g/cm^3

____ 63. What is the volume of 45.6 g of silver if the density of silver is 10.5 g/mL?
a. 0.23 mL
b. 4.34 mL
c. 479 mL
d. none of the above

____ 64. If a liter of water is heated from 20°C to 50°C, what happens to its volume?
a. The volume decreases.
b. The volume increases.
c. The volume first increases, then decreases.
d. The volume first decreases, then increases.

____ 65. If the temperature of a piece of steel decreases, what happens to its density?
a. The density decreases.
b. The density increases.
c. The density does not change.
d. The density first increases, then decreases.

____ 66. As the density of a substance increases, the volume of a given mass of that substance ____.
a. increases
b. is not affected
c. decreases
d. fluctuates

____ 67. The calculation of quantities in chemical equations is called ____.
a. stoichiometry
b. dimensional analysis
c. percent composition
d. percent yield

____ 68. What is conserved in the reaction shown below?
$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
a. mass only
b. mass and moles only
c. mass, moles, and molecules only
d. mass, moles, molecules, and volume

____ 69. What is conserved in the reaction shown below?
$N_2(g) + 3F_2(g) \rightarrow 2NF_3(g)$
a. atoms only
b. mass only
c. mass and atoms only
d. moles only

____ 70. In every chemical reaction, ____.
a. mass and molecules are conserved
b. moles and liters are conserved
c. mass and atoms are conserved
d. moles and molecules are conserved

____ 71. The first step in most stoichiometry problems is to ____.
a. add the coefficients of the reagents
b. convert given quantities to moles
c. convert given quantities to volumes
d. convert given quantities to masses

____ 72. In the reaction $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$, what is the ratio of moles of oxygen used to moles of CO_2 produced?
a. 1:1
b. 2:1
c. 1:2
d. 2:2

____ 73. Which of the following is an INCORRECT interpretation of the balanced equation shown below?
$2S(s) + 3O_2(g) \rightarrow 2SO_3(g)$

a. 2 atoms S + 3 molecules $O_2 \rightarrow$ 2 molecules SO_3
b. 2 g S + 3 g $O_2 \rightarrow$ 2 g SO_3
c. 2 mol S + 3 mol $O_2 \rightarrow$ 2 mol SO_3
d. none of the above

____ 74. How many moles of aluminum are needed to react completely with 1.2 mol of FeO?
$2Al(s) + 3FeO(s) \rightarrow 3Fe(s) + Al_2O_3(s)$

a. 1.2 mol
b. 0.8 mol
c. 1.6 mol
d. 2.4 mol

____ 75. When iron rusts in air, iron(III) oxide is produced. How many moles of oxygen react with 2.4 mol of iron in the rusting reaction?
$4Fe(s) + 3O_2(g) \rightarrow 2Fe2O_3(s)$

a. 1.2 mol
b. 1.8 mol
c. 2.4 mol
d. 3.2 mol

____ 76. At STP, how many liters of oxygen are required to react completely with 3.6 liters of hydrogen to form water?
$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

a. 1.8 L
b. 3.6 L
c. 2.0 L
d. 2.4 L

____ 77. Which type of stoichiometric calculation does not require the use of the molar mass?

a. mass-mass problems
b. mass-volume problems
c. mass-particle problems
d. volume-volume problems

____ 78. When glucose is consumed, it reacts with oxygen in the body to produce carbon dioxide, water, and energy. How many grams of carbon dioxide would be produced if 45 g of $C_6H_{12}O_6$ completely reacted with oxygen?

a. 1.5 g
b. 1.8 g
c. 11 g
d. 66 g

____ 79. How many moles of H_3PO_4 are produced when 71.0 g P_4O_{10} reacts completely to form H_3PO_4?
$P_4O_{10}(s) + 6H_2O(l) \rightarrow 4H_3PO_4(aq)$

a. 0.063 5 mol
b. 1.00 mol
c. 4.00 mol
d. 16.0 mol

____ 80. How many liters of hydrogen gas are needed to react with CS_2 to produce 2.50 L of CH_4 at STP?
$4H_2(g) + CS_2(l) \rightarrow CH_4(g) + 2H_2S(g)$

a. 2.50 L
b. 5.00 L
c. 7.50 L
d. 10.0 L

____ 81. How many grams of chromium are needed to react with an excess of $CuSO_4$ to produce 27.0 g Cu?
$2Cr(s) + 3CuSO_4(aq) \rightarrow Cr_2(SO_4)_3(aq) + 3Cu(s)$

a. 14.7 g
b. 18.0 g
c. 33.2 g
d. 81.5 g

____ 82. How many liters of chlorine gas can be produced when 0.98 L of HCl react with excess O_2 at STP?
$4HCl(g) + O_2(g) \rightarrow 2Cl_2(g) + 2H_2O(g)$

a. 0.98 L
b. 0.49 L
c. 3.9 L
d. 2.0 L

____ 83. What SI unit is used to measure the number of representative particles in a substance?
a. kilogram
b. ampere
c. kelvin
d. mole

____ 84. How many hydrogen atoms are in 5 molecules of isopropyl alcohol, C_3H_7O?
a. $5 \times (6.02 \times 10^{23})$
b. 5
c. 35
d. $35 \times (6.02 \times 10^{23})$

____ 85. Which of the following is a representative particle?
a. atom
b. cation
c. anion
d. all of the above

____ 86. Which of the following elements exists as a diatomic molecule?
a. neon
b. lithium
c. nitrogen
d. sulfur

____ 87. Avogadro's number of representative particles is equal to one ____.
a. kilogram
b. gram
c. kelvin
d. mole

____ 88. All of the following are equal to Avogadro's number EXCEPT ____.
a. the number of atoms of bromine in 1 mol Br_2
b. the number of atoms of gold in 1 mol Au
c. the number of molecules of nitrogen in 1 mol N_2
d. the number of molecules of carbon monoxide in 1 mol CO

____ 89. How many moles of tungsten atoms are in 4.8×10^{25} atoms of tungsten?
a. 8.0×10^{2} moles
b. 8.0×10^{1} moles
c. 1.3×10^{-1} moles
d. 1.3×10^{-2} moles

____ 90. How many moles of silver atoms are in 1.8×10^{20} atoms of silver?
a. 3.0×10^{-4}
b. 3.3×10^{-3}
c. 3.0×10^{2}
d. 1.1×10^{-44}

____ 91. How many atoms are in 0.075 mol of titanium?
a. 1.2×10^{-25}
b. 2.2×10^{-24}
c. 6.4×10^{2}
d. 4.5×10^{22}

____ 92. How many molecules are in 2.10 mol CO_2?
a. 2.53×10^{24} molecules
b. 3.79×10^{24} molecules
c. 3.49×10^{-24} molecules
d. 1.26×10^{24} molecules

____ 93. How many atoms are in 3.5 moles of arsenic atoms?
a. 5.8×10^{-24} atoms
b. 7.5×10^{1} atoms
c. 2.1×10^{24} atoms
d. 1.7×10^{23} atoms

____ 94. Butanol is composed of carbon, hydrogen, and oxygen. If 1.0 mol of butanol contains 6.0×10^{24} atoms of hydrogen, what is the subscript for the hydrogen atom in C_4H_2O?
a. 1
b. 10
c. 6
d. 8

____ 95. Which of the following is NOT a true about atomic mass?
a. The atomic mass is 12 g for magnesium.
b. The atomic mass is the mass of one mole of atoms.
c. The atomic mass is found by checking the periodic table.
d. The atomic mass is the number of grams of an element that is numerically equal to the mass in amu.

____ 96. What is true about the molar mass of chlorine gas?
a. The molar mass is 35.5 g.
b. The molar mass is 71.0 g.
c. The molar mass is equal to the mass of one mole of chlorine atoms.
d. none of the above

____ 97. What is the molar mass of $AuCl_3$?
a. 96 g
b. 130 g
c. 232.5 g
d. 303.6 g

____ 98. What is the molar mass of $(NH_4)_2CO_3$?
a. 144 g
b. 138 g
c. 96 g
d. 78 g

____ 99. What is the mass in grams of 5.90 mol C_8H_{18}?
a. 0.0512 g
b. 19.4 g
c. 389 g
d. 673 g

____ 100. What is the number of moles in 432 g $Ba(NO_3)_2$?
a. 0.237 mol
b. 0.605 mol
c. 1.65 mol
d. 3.66 mol

____ 101. How many moles of $CaBr_2$ are in 5.0 grams of $CaBr_2$?
a. 2.5×10^{-2} mol
b. 4.2×10^{-2} mol
c. 4.0×10^{1} mol
d. 1.0×10^{3} mol

____ 102. For which of the following conversions does the value of the conversion factor depend upon the formula of the substance?
a. volume of gas (STP) to moles
b. density of gas (STP) to molar mass
c. mass of any substance to moles
d. moles of any substance to number of particles

____ 103. What is the mass of oxygen in 250 g of sulfuric acid, H_2SO_4?
a. 0.65 g
b. 3.9 g
c. 16 g
d. 160 g

____ 104. The volume of one mole of a substance is 22.4 L at STP for all ____.
a. gases
b. liquids
c. solids
d. compounds

____ 105. The molar volume of a gas at STP occupies ____.
a. 22.4 L
b. 0°C
c. 1 kilopascal
d. 12 grams

____ 106. What is the volume, in liters, of 0.500 mol of C_3H_8 gas at STP?
a. 0.0335 L
b. 11.2 L
c. 16.8 L
d. 22.4 L

____ 107. What is the number of moles in 500 L of He gas at STP?
a. 0.05 mol
b. 0.2 mol
c. 22 mol
d. 90 mol

____ 108. What is the density at STP of the gas sulfur hexafluoride, SF_6?
a. 0.153 g/L
b. 6.52 g/L
c. 3270 g/L
d. 3.93×10^{-24} g/L

____ 109. A 22.4-L sample of which of the following substances, at STP, would contain 6.02×10^{23} representative particles?
a. oxygen
b. gold
c. cesium iodide
d. sulfur

____ 110. If the density of an unknown gas Z is 4.50 g/L at STP, what is the molar mass of gas Z?
a. 0.201 g/mol
b. 5.00 g/mol
c. 26.9 g/mol
d. 101 g/mol

____ 111. Given 1.00 mole of each of the following gases at STP, which gas would have the greatest volume?
a. He
b. O_2
c. SO_3
d. All would have the same volume.

____ 112. What information is needed to calculate the percent composition of a compound?
a. the weight of the sample to be analyzed and its density
b. the weight of the sample to be analyzed and its molar volume
c. the formula of the compound and the atomic mass of its elements
d. the formula of the compound and its density

____ 113. If 60.2 grams of Hg combines completely with 24.0 grams of Br to form a compound, what is the percent composition of Hg in the compound?
a. 28.5%
b. 39.9%
c. 71.5%
d. 60.1%

____ 114. If 20.0 grams of Ca combines completely with 16.0 grams of S to form a compound, what is the percent composition of Ca in the compound?
a. 1.25%
b. 20.0%
c. 44.4%
d. 55.6%

____ 115. What is the percent composition of carbon, in heptane, C_7H_{16}?
a. 12%
b. 19%
c. 68%
d. 84%

____ 116. Which of the following compounds has the lowest percent gold content by weight?
a. AuOH
b. $Au(OH)_3$
c. $AuCl_3$
d. AuI_3

____ 117. Which of the following is NOT an empirical formula?
a. $C_2N_2H_8$
b. C_3H_8O
c. $BeCr_2O_7$
d. Sb_2S_3

____ 118. Which of the following compounds have the same empirical formula?
a. CO_2 and SO_2
b. C_7H_{14} and $C_{10}H_{20}$
c. C_4H_{10} and $C_{10}H_4$
d. C_6H_{12} and C_6H_{14}

____ 119. What is the empirical formula of a substance that is 53.5% C, 15.5% H, and 31.1% N by weight?
a. C_3HN_2
b. $C_4H_{14}N_2$
c. C_2H_8N
d. CH_4N_7

____ 120. Which of the following is NOT true about empirical and molecular formulas?
a. The molecular formula of a compound can be the same as its empirical formula.
b. The molecular formula of a compound can be some whole-number multiple of its empirical formula.
c. Several compounds can have the same empirical formula, but have different molecular formulas.
d. The empirical formula of a compound can be triple its molecular formula.

____ 121. According to the kinetic theory, collisions between molecules in a gas ____.
a. are perfectly elastic
b. are inelastic
c. never occur
d. cause a loss of total kinetic energy

____ 122. Which of the following statements is part of the kinetic theory?
a. The particles of a gas move independently of each other.
b. The particles in a gas move rapidly.
c. The particles in a gas are relatively far apart.
d. all of the above

____ 123. The average speed of oxygen molecules in air is about ____.
a. 0 km/h
b. 170 km/h
c. 1700 km/h
d. 17,000 km/h

____ 124. Which of the following statements is NOT true, according to the kinetic theory?
a. There is no attraction between particles of a gas.
b. Only particles of matter in the gaseous state are in constant motion.
c. The particles of a gas collide with each other and with other objects.
d. All of the statements are true.

____ 125. Particles in a gas are best described as ____.
a. slow-moving, kinetic, hard spheres
b. spheres that are in fixed positions when trapped in a container
c. small, hard spheres with insignificant volumes
d. hard spheres influenced by repulsive forces from other spheres

____ 126. Which of the following statements is NOT true about the movement of particles in a gas?
a. Particles travel in straight-line paths until they collide with other objects.
b. Particles usually travel uninterrupted indefinitely.
c. Particles fill their containers regardless of the shape or volume of the container.
d. The aimless path taken by particles is known as a random walk.

____ 127. What is the SI unit of pressure?
a. candela
b. mole
c. pascal
d. newton

____ 128. Standard conditions when working with gases are defined as ____.
a. 0 K and 101.3 kPa
b. 0 K and 1 kPa
c. 0°C and 101.3 kPa
d. 0°C and 1 kPa

____ 129. How does the atmospheric pressure at altitudes below sea level compare with atmospheric pressure at sea level?
a. The atmospheric pressure below sea level is higher.
b. The atmospheric pressure below sea level is lower.
c. The pressures are the same.
d. Differences in pressures cannot be determined.

____ 130. What causes gas pressure in a container such as a helium balloon?
a. the walls of the container
b. the vacuum maintained in the container
c. the simultaneous collisions of fast-moving particles in the container
d. atmospheric pressure acting on the outside walls of the container

____ 131. The pressure of a gas in a container is 152 mm Hg. This is equivalent to ____.
a. 0.2 atm
b. 2 atm
c. 0.3 atm
d. 0.4 atm

____ 132. What happens to the average kinetic energy of the particles in a sample of matter as the temperature of the sample is increased?
a. The average kinetic energy decreases.
b. The average kinetic energy increases.
c. The average kinetic energy does not change.
d. The change in average kinetic energy cannot be determined.

____ 133. With which temperature scale is temperature directly proportional to average kinetic energy?
a. Celsius
b. Fahrenheit
c. Kelvin
d. centigrade

____ 134. What happens to the range of energies of the particles in matter when the temperature is increased?
a. The range of energies becomes narrower.
b. The range of energies becomes broader.
c. The range of energies does not change.
d. The range of energies cannot be determined.

____ 135. When a gas is heated, ____.
a. all of the absorbed energy is converted to kinetic energy
b. some of the absorbed energy is converted to potential energy, and some is converted to kinetic energy
c. all of the absorbed energy is converted to potential energy
d. none of the energy is converted to kinetic energy

____ 136. The average kinetic energy of water molecules is greatest in ____.
a. steam at 100°C
b. liquid water at 90°C
c. liquid water at 373 K
d. ice at 0°C

____ 137. What is the key difference between a liquid and a gas?
a. intermolecular attractions
b. the ability to flow
c. average kinetic energy
d. the motion of their particles

____ 138. Which states of matter can flow?
a. gases only
b. liquids only
c. gases and liquids only
d. gases, liquids, and solids

____ 139. What happens to the temperature of a liquid as it evaporates?
a. It increases.
b. It decreases.
c. It does not change.
d. The change cannot be determined.

____ 140. Which are the first particles to evaporate from a liquid?
a. particles with the lowest kinetic energy
b. particles with the highest kinetic energy
c. particles below the surface of the liquid
d. All particles evaporate at the same rate.

____ 141. What happens to the rate of evaporation of a liquid as the liquid is cooled?
a. It increases.
b. It decreases.
c. It does not change.
d. The change cannot be determined.

____ 142. Why does a liquid's rate of evaporation increase when the liquid is heated?
a. More molecules have enough energy to overcome the attractive forces holding them in the liquid.
b. The average kinetic energy of the liquid decreases.
c. The surface area of the liquid is reduced.
d. The potential energy of the liquid increases.

____ 143. Which of the following will evaporate the fastest?
a. water at 0°C
b. water at 20°C
c. water at 40°C
d. All samples will evaporate at the same rate.

____ 144. In a dynamic equilibrium between the liquid state and the gas state, what is true about the rate of evaporation?
a. It is greater than the rate of condensation.
b. It is less than the rate of condensation.
c. It is equal to the rate of condensation.
d. The rate of evaporation cannot be determined.

____ 145. If a liquid is sealed in a container and kept at constant temperature, how does its vapor pressure change over time?
a. It continues to steadily increase.
b. It increases at first, then remains constant.
c. It increases at first, then decreases.
d. It continues to steadily decrease.

____ 146. An increase in the temperature of a contained liquid ____.
a. has no effect on the kinetic energy of the liquid
b. causes the vapor pressure above the liquid to decrease
c. causes fewer particles to escape from the surface of the liquid
d. causes the vapor pressure above the liquid to increase

____ 147. If energy is added to a boiling liquid, what happens to the temperature of the liquid?
a. It increases.
b. It decreases.
c. It does not change.
d. The change cannot be determined.

____ 148. What is the pressure when a liquid is boiling at its normal boiling point?
a. 0 kPa
b. 101.3 kPa
c. 202 kPa
d. 505 kPa

____ 149. Water could be made to boil at 105°C instead of 100°C by ____.
a. adding a lot of energy to the water
b. increasing the external pressure
c. decreasing the external pressure
d. taking the sample to a higher altitude

____ 150. The normal boiling point of chloroform, which has a higher vapor pressure than water at 100°C, is ____.
a. higher than the normal boiling point of water
b. lower than the normal boiling point of water
c. the same as the normal boiling point of water
d. unable to be measured

____ 151. Which of the following best describes the motion of the particles in a piece of steel?
a. None are moving.
b. A few are moving.
c. All are moving.
d. Most are moving.

____ 152. Most solids ____.
a. are dense and difficult to compress
b. are able to flow
c. are amorphous
d. have a disorderly structure

____ 153. The smallest group of particles in a crystal that retains the shape of the crystal is called the ____.
a. cube
b. unit cell
c. cage
d. crystal lattice

____ 154. The escape of molecules from the surface of a liquid is known as ____.
a. condensation
b. boiling
c. evaporation
d. sublimation

____ 155. Which of the following elements has the ability to undergo sublimation?
a. oxygen
b. carbon
c. sodium
d. iodine

____ 156. The direct change of a substance from a solid to a gas is called ____.
a. evaporation
b. sublimation
c. condensation
d. solidification

____ 157. Which of the following is an example of a phase?
a. pressure
b. water vapor
c. temperature
d. triple point

____ 158. Why is a gas easier to compress than a liquid or a solid?
a. Its volume increases more under pressure than an equal volume of liquid does.
b. Its volume increases more under pressure than an equal volume of solid does.
c. The space between gas particles is much less than the space between liquid or solid particles.
d. The volume of a gas's particles is small compared to the overall volume of the gas.

____ 159. Why does the pressure inside a container of gas increase if more gas is added to the container?
a. There is an increase in the number of collisions between particles and the walls of the container.
b. There is an increase in the temperature of the gas.
c. There is a decrease in the volume of the gas.
d. There is an increase in the force of the collisions between the particles and the walls of the container.

____ 160. How does the gas propellant move when an aerosol can is used?
a. from a region of high pressure to a region of lower pressure
b. from a region of high pressure to a region of equally high pressure
c. from a region of low pressure to a region of higher pressure
d. from a region of low pressure to a region of equally low pressure

____ 161. If the volume of a container of gas is reduced, what will happen to the pressure inside the container?
a. The pressure will increase.
b. The pressure will not change.
c. The pressure will decrease.
d. The pressure depends on the type of gas.

____ 162. What happens to the temperature of a gas when it is compressed?
a. The temperature increases.
b. The temperature does not change.
c. The temperature decreases.
d. The temperature becomes unpredictable.

____ 163. What happens to the pressure of a gas inside a container if the temperature of the gas decreases?
a. The pressure increases.
b. The pressure does not change.
c. The pressure decreases.
d. The pressure cannot be predicted.

____ 164. Why does air escape from a tire when the tire valve is opened?
a. The pressure outside the tire is lower than the pressure inside the tire.
b. The pressure outside the tire is greater than the pressure inside the tire.
c. The temperature is higher outside the tire than inside the tire.
d. There are more particles of air outside the tire than inside the tire.

____ 165. When the Kelvin temperature of an enclosed gas doubles, the particles of the gas ____.
a. move faster
b. strike the walls of the container with less force
c. decrease in average kinetic energy
d. decrease in volume

____ 166. The volume of a gas is doubled while the temperature is held constant. How does the gas pressure change?
a. It is reduced by one half.
b. It does not change.
c. It is doubled.
d. It varies depending on the type of gas.

____ 167. Boyle's law states that ____.
a. the volume of a gas varies inversely with pressure
b. the volume of a gas varies directly with pressure
c. the temperature of a gas varies inversely with pressure
d. the temperature of a gas varies directly with pressure

____ 168. When the temperature and number of particles of a gas are constant, which of the following is also constant?
a. the sum of the pressure and volume
b. the difference of the pressure and volume
c. the product of the pressure and volume
d. the ratio of the pressure and volume

____ 169. Charles's law states that ____.
a. the pressure of a gas is inversely proportional to its temperature in kelvins
b. the volume of a gas is directly proportional to its temperature in kelvins
c. the pressure of a gas is directly proportional to its temperature in kelvins
d. the volume of a gas is inversely proportional to its temperature in kelvins

____ 170. When the pressure and number of particles of a gas are constant, which of the following is also constant?
a. the sum of the volume and temperature in kelvins
b. the difference of the volume and temperature in kelvins
c. the product of the volume and temperature in kelvins
d. the ratio of the volume and temperature in kelvins

____ 171. When the volume and number of particles of a gas are constant, which of the following is also constant?
a. the sum of the pressure and temperature in kelvins
b. the difference of the pressure and temperature in kelvins
c. the product of the pressure and temperature in kelvins
d. the ratio of the pressure and temperature in kelvins

____ 172. If a sealed syringe is plunged into cold water, in which direction will the syringe piston slide?
a. in
b. out
c. No movement will occur.
d. The direction cannot be predicted.

____ 173. What happens when a piston is used to decrease the volume of a contained gas?
a. Fewer gas particles exert a force on the piston.
b. The piston’s pressure on the gas becomes greater than the pressure exerted by the gas on the piston.
c. Gas particles become compressed.
d. Gas particles leak out of the container.

____ 174. If a sealed syringe is heated, in which direction will the syringe plunger move?
a. out
b. in
c. The plunger will not move.
d. The direction cannot be predicted.

____ 175. A sample of gas occupies 17 mL at –112°C. What volume does the sample occupy at 70°C?

a. 10.6 mL
c. 36mL
b. 27 mL
d. 8.0mL

____ 176. In general, for a gas at a constant volume, ____.

a. the pressure of the gas is inversely proportional to its temperature in kelvins
b. the volume of the gas is inversely proportional to its temperature in kelvins
c. the volume of the gas is directly proportional to its temperature in kelvins
d. the pressure of the gas is directly proportional to its temperature in kelvins

____ 177. The combined gas law relates which of the following?

a. pressure and volume only
c. volume and temperature only
b. temperature and pressure only
d. temperature, pressure, and volume

____ 178. If a balloon containing 3000 L of gas at 39°C and 99 kPa rises to an altitude where the pressure is 45.5 kPa and the temperature is 16°C, the volume of the balloon under these new conditions would be calculated using the following conversion factor ratios: ____.

a. $3000\ \text{L} \times \frac{99}{45.5} \times \frac{16}{39}$
c. $3000\ \text{L} \times \frac{289}{312} \times \frac{99}{45.5}$
b. $3000\ \text{L} \times \frac{312}{289} \times \frac{45.5}{99}$
d. $3000\ \text{L} \times \frac{39}{16} \times \frac{45.5}{99}$

____ 179. At a certain temperature and pressure, 0.20 mol of carbon dioxide has a volume of 3.1 L. A 3.1-L sample of hydrogen at the same temperature and pressure ____.

a. has the same mass
b. contains the same number of atoms
c. has a higher density
d. contains the same number of molecules

____ 180. How is the ideal gas law usually written?

a. $\frac{PV}{nT} = R$
c. $PV = nRT$
b. $\frac{PV}{T} = nR$
d. $P = \frac{nRT}{V}$

____ 181. Which of the following is constant for 1 mole of any ideal gas?

a. PVT
c. $\frac{PT}{V}$
b. $\frac{PV}{T}$
d. $\frac{VT}{P}$

____ 182. At high pressures, how does the volume of a real gas compare with the volume of an ideal gas under the same conditions?

a. It is much greater.
c. There is no difference.
b. It is much less.
d. It depends on the type of gas.

____ 183. At low temperatures and pressures, how does the volume of a real gas compare with the volume of an ideal gas under the same conditions?

a. It is greater.
c. There is no difference.
b. It is less.
d. It depends on the type of gas.

____ 184. Under what conditions of temperature and pressure is the behavior of real gases most like that of ideal gases?

a. low temperature and low pressure
c. high temperature and low pressure
b. low temperature and high pressure
d. high temperature and high pressure

____ 185. If the atmospheric pressure on Mt. Everest is one-third the atmospheric pressure at sea level, the partial pressure of oxygen on Everest is ____.

a. one-sixth its pressure at sea level
c. one-half its pressure at sea level
b. one-third its pressure at sea level
d. equal to its pressure at sea level

____ 186. If oxygen is removed from a sample of air as iron rusts, what happens to the partial pressure of oxygen in the air?

a. It increases.
b. It stays the same.
c. It decreases.
d. The change cannot be determined.

____ 187. A breathing mixture used by deep-sea divers contains helium, oxygen, and carbon dioxide. What is the partial pressure of oxygen at 101.4 kPa if P_{He} = 82.5 kPa and P_{CO_2} = 0.4 kPa?

a. 82.9 kPa
b. 19.3 kPa
c. 18.5 kPa
d. 101.0 kPa

____ 188. When a container is filled with 3.00 moles of H_2, 2.00 moles of O_2, and 1.00 mole of N_2, the pressure in the container is 768 kPa. What is the partial pressure of O_2?

a. 256 kPa
b. 128 kPa
c. 128 kPa
d. 192 kPa

____ 189. The tendency of molecules to move toward areas of lower concentration is called ____.

a. suffusion
b. suspension
c. effusion
d. diffusion

____ 190. Which of the following atoms would have the greatest velocity if each atom had the same kinetic energy?

a. bromine
b. chlorine
c. ammonia
d. hydrogen

____ 191. Which of the following gases is the best choice for inflating a balloon that must remain inflated for a long period of time?

a. argon
b. oxygen
c. hydrogen
d. neon

____ 192. What is the term for the dissolving medium in a solution?

a. solvent
b. solute
c. solvator
d. emulsifier

____ 193. A solution has which of the following properties?

a. Gravity separates its parts.
b. The top layer is different in composition than the bottom layer.
c. The average diameter of its solute particles usually is less than 1 nm.
d. A filter can remove the solute.

____ 194. A solution is a mixture ____.

a. from which the solute can be filtered
b. that has the same properties throughout
c. that is heterogeneous
d. in which a solid solute is always dissolved in a liquid solvent

____ 195. Predict which one of the following compounds would be insoluble in water.

a. NaCl
b. HCl
c. CF_4
d. $CuSO_4$

____ 196. Why are two nonpolar substances able to dissolve in each other?

a. They have similar attractive forces in their molecules.
b. They combine to produce a polar substance.
c. There is no attractive force between them.
d. Nonpolar substances cannot dissolve in each other.

____ 197. Which of the following mixture types can be filtered to remove solute?

a. suspensions only
b. colloids only
c. suspensions and colloids
d. suspensions and solutions

Short Answer

198. Round off the measurement 0.003 095 5 m to three significant figures.

199. What is the sum of 2.7 g and 2.47 g expressed in the correct number of significant digits?

200. What is the sum of 6.210 L and 3 L expressed in the correct number of significant digits?

201. What is the product of the number 1000 and the measurement 0.003 57 m expressed in the correct number of significant digits?

202. The mass of the electron is $9.109\ 39 \times 10^{-31}$ kg. Express the mass of the electron to 1, 2, 3, and 4 significant figures.

203. Perform the following operation: 3.43 cm $\times$ 5.2 cm. Make sure that your answer has the correct number of significant figures.

204. What is the temperature 128 K expressed in degrees Celsius?

205. Express 0.05 grams in kilograms, using the correct abbreviations.

206. Express 0.06 liters in cubic meters, using the correct abbreviations.

207. What is the density of an object having a mass of 4.0 g and a volume of 39.0 cubic centimeters?

208. What is the volume of an object with a density of 7.73 g/cm^3 and a mass of 5.40×10^{2} g?

209. If 8.00 mol of NH_3 reacted with 14.0 mol of O_2, how many moles of H_2O will be produced?
$4NH_3(g) + 7O_2(g) \rightarrow 4NO_2 + 6H_2O(g)$

210. If 8.6 L of H_2 reacted with 4.3 L of O_2 at STP, what is the volume of the gaseous water collected (assuming that none of it condenses)?
$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

211. What is the mole ratio of D to A in the generic chemical reaction?
$2A + B \rightarrow C + 3D$

212. How many representative particles are in 1.45 g of a molecular compound with a molar mass of 237 g?

213. Find the mass in grams of 3.10×10^{23} molecules of F_2.

214. Find the number of moles of argon in 607 g of argon.

215. Find the mass, in grams, of 1.40×10^{23} molecules of N_2.

216. What is a pressure of 0.520 atm equal to in mm of Hg?

217. What is a pressure of 622 mm Hg equal to in atm?

218. At what temperature do particles theoretically have no kinetic energy?

219. The vapor pressure of 10 mL of ethanol at 20°C is 5.85 kPa. What is the vapor pressure of 20 mL of ethanol at the same temperature?

220. What is the pressure (in atm) at the normal boiling point of water?

221. What is the angle measurement in cubic, tetragonal, and orthorhombic crystal systems?

222. The volume of a gas is 250 mL at 340.0 kPa pressure. What will the volume be when the pressure is reduced to 50.0 kPa, assuming the temperature remains constant?

223. A balloon filled with helium has a volume of 30.0 L at a pressure of 100 kPa and a temperature of 15.0°C. What will the volume of the balloon be if the temperature is increased to 80.0°C and the pressure remains constant?

224. A gas has a volume of 590 mL at a temperature of –55.0°C. What volume will the gas occupy at 30.0°C?

225. A rigid container of O_2 has a pressure of 340 kPa at a temperature of 713 K. What is the pressure at 273 K?

226. A 10-g mass of krypton occupies 15.0 L at a pressure of 210 kPa. Find the volume of the krypton when the pressure is increased to 790 kPa.

227. A gas has a pressure of 710 kPa at 227°C. What will its pressure be at 27°C, if the volume does not change?

228. A gas occupies a volume of 140 mL at 35.0°C and 97 kPa. What is the volume of the gas at STP?

229. A gas storage tank has a volume of 3.5×10^{5} m^{3} when the temperature is 27°C and the pressure is 101 kPa. What is the new volume of the tank if the temperature drops to –10°C and the pressure drops to 95 kPa?

230. How many moles of N_2 are in a flask with a volume of 250 mL at a pressure of 300.0 kPa and a temperature of 300.0 K?

231. The gaseous product of a reaction is collected in a 25.0-L container at 27°C. The pressure in the container is 300.0 kPa and the gas has a mass of 96.0 g. How many moles of the gas are in the container?

232. What is the pressure exerted by 32 g of O_2 in a 22.0-L container at 30.0°C?

233. Use Graham's law to calculate how much faster fluorine gas, F_2, will effuse than chlorine gas, Cl_2, will. The molar mass of F_2 = 38.0; the molar mass of Cl_2 = 70.9.

Essay

234. Explain the difference between precision and accuracy. Suppose you made three different mass measurements of a sugar sample you knew to have a mass of 1 g. How would you know whether or not the measurements were accurate? How would you know whether or not they were precise? Could the three measurements be precise, but not accurate? Explain.

235. Describe the rules that are used to determine the number of significant figures in the results of addition, subtraction, multiplication, and division.

236. Why is the metric system the preferred system of measurement for science?

237. Explain the difference between the Celsius and Kelvin temperature scales.

238. How does the air pressure in a balloon change when the balloon is squeezed? Explain why this change occurs.

239. How does the pressure of an enclosed gas in a rigid container change when the gas is heated? Explain why this change occurs.

240. Explain how pumping air into a bicycle tire increases the pressure within the tire.

241. What are some of the differences between a real gas and an ideal gas?

242. What is Dalton's law of partial pressures? Explain how this law relates to the fact that mountain climbers must carry tanks of oxygen when scaling high peaks.

243. Explain why the rates of diffusion and effusion, for any particular gas at constant temperature, are proportional to the square root of the molar mass of the gas.