Directions: Please choose the best answer choice for each of the following questions.

1. Which of these elements would have the greatest electronegativity?
   A. nitrogen (N)
   B. oxygen (O)
   C. phosphorous (P)
   D. sulfur (S)

2. Which group of elements is the most reactive?
   A. alkali metals
   B. alkaline earth metals
   C. transition metals
   D. noble gases

3. Transition metals are characterized by having the outermost electrons in which orbital?
   A. s
   B. p
   C. d
   D. f

4. Which of these is an alkaline earth metal?
   A. cesium (Cs)
   B. barium (Ba)
   C. tungsten (W)
   D. astatine (At)

5. Which of the following would you expect to have the largest atomic radius?
   A. calcium (Ca)
   B. iodine (I)
   C. potassium (K)
   D. cesium (Cs)

6. Generally the size of an ion in relation to its size as an atom will
   A. increase as it becomes more positive.
   B. increase as it loses electrons.
   C. remain about the same.
   D. increase as it becomes more negative.

7. Which statement about noble gases is correct?
   A. They form compounds with very bright colors.
   B. They exist as single atoms rather than as molecules.
   C. They are highly reactive with both metals and nonmetals.
   D. They are extremely rare in nature.

8. Where are halogens located on the periodic table?
   A. Group 1
   B. Groups 3-12
   C. Group 17
   D. Groups 4-18

9. Which of the following lists contains all non-metal elements?
   A. Ba, P, S, Th
   B. C, Pb, Ge, Sn
   C. B, As, Si, Br
   D. N, Se, Cl, Ar

10. Which of the following represents a group or family of elements?
    A. potassium (K), calcium (Ca), scandium (Sc)
    B. beryllium (Be), magnesium (Mg), calcium (Ca)
    C. carbon (C), nitrogen (N), silicon (Si)
    D. magnesium (Mg), calcium (Ca), tin (Sn)

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11. Which set of elements are halogens?
    A. helium (He), neon (Ne), argon (Ar)
    B. lithium (Li), sodium (Na), potassium (K)
    C. bromine (Br), iodine (I), chlorine (Cl)
    D. boron (B), aluminum (Al), gallium (Ga)

12. Use the periodic table to identify which element is a metal. The element with an atomic number of ____.
    A. 2
    B. 16
    C. 23
    D. 33

13. An element has 9 protons, 9 electrons and 10 neutrons. What is this element?
    A. fluorine (F)
    B. neon (Ne)
    C. argon (Ar)
    D. potassium (K)

14. As you move from right to left on the periodic table
    A. the atomic number decreases.
    B. the atomic mass decreases.
    C. the atomic mass increases.
    D. the radioactivity increases.

15. Valence electrons determine an atom´s
    A. mass.
    B. chemical properties.
    C. electric charge.
    D. period.

16. Atoms of elements that are in the same group have the same number of
    A. protons.
    B. neutrons.
    C. valence electrons.
    D. protons and neutrons.

17. The order of elements in the periodic table is based on
    A. the number of protons in the nucleus.
    B. the electric charge of the nucleus.
    C. the number of neutrons in the nucleus.
    D. atomic mass.

18. Across a period (row) in the periodic table, the ionization energy _____ because the _____.
    A. increases; atoms become larger in size
    B. increases; electrons are held more tightly
    C. decreases; atoms are smaller in size
    D. decreases; electrons are held more tightly

19. Based on the periodic trend for the size of atoms and ions, which is expected to have the largest radius?
    A. a fluorine atom (F)
    B. a fluoride ion F^{-1}
    C. a sulfur atom (S)
    D. a sulfur ion S^{-2}

20. Which element has the lowest ionization energy (energy need to remove an electron)?
    A. boron (B)
    B. carbon (C)
    C. nitrogen (N)
    D. fluorine (F)

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21. Covalent bonds are formed between
    A. ions.
    B. metal atoms.
    C. nonmetal atoms.
    D. compounds.

22. Which set of atoms has (1) electron for bonding?
    A. hydrogen (H) and Helium (He)
    B. lithium (Li) and fluorine (F)
    C. helium (He) and neon (Ne)
    D. lithium (Li) and sodium (Na)

23. An ionic bond is a bond that forms between
    A. ions with opposite charges.
    B. atoms with neutral charges.
    C. one atom´s nucleus and another atom´s electrons.
    D. the electrons of two different atoms.

24. In relation to the atom, the nucleus has the
    A. most mass and least volume.
    B. most mass and most volume.
    C. least mass and most volume.
    D. least mass and least volume.

25. The particle with the least mass would be the
    A. proton.
    B. neutron.
    C. nucleus.
    D. electron.

26. Which of the following electron configurations describes a halogen?
    A. $1s^2 2s^2 2p^2 3s^2 3p^6 3d^{1\circ} 4s^2 4p^6$
    B. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{1\circ} 4s^2 4p^5$
    C. $1s^2 2s^2 2p^2 3s^2 3p^6 3d^{1\circ} 4s^2 4p^4$
    D. $1s^2 2s^2 2p^2 3s^2 3p^6 3d^{1\circ} 4s^2 4p^3$

27. What element has the electron configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$?
    A. lithium
    B. sodium
    C. chlorine
    D. potassium

28. The deflection pattern of alpha particles shot at gold foil in Rutherford's experiments lead to the discovery of the
    A. proton.
    B. neutron.
    C. dense nucleus.
    D. electron cloud.

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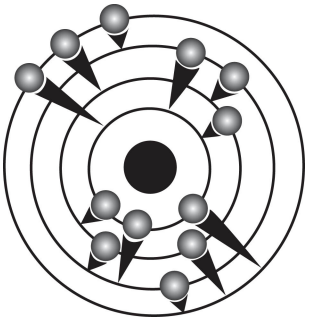
29. 
The diagram shows electrons jumping between energy levels in an atom. Niels Bohr discovered that when electrons move from higher to lower energy levels (for example, n = 6 to n = 4),

A. energy is absorbed and the electron goes to a stable state.

B. energy is absorbed and the electron goes to an unstable state.

C. energy is released and the electron goes to a stable state.

D. energy is released and the electron goes to an unstable state.

30. According to modern atomic theory, it is nearly impossible to determine an electron´s exact

A. color.

B. position.

C. charge

D. mass.

31. Nucleic acid molecules are complex polymer molecules made up of repetitive monomers called

A. nucleotides.

B. complex sugars.

C. simple sugars.

D. vitamins.

32. Starch molecules are complex polymer molecules made up of repetitive monomers called

A. amino acids.

B. nucleic acids.

C. simple sugars.

D. viamins.

33. Proteins molecules are complex polymer molecules made up of repetitive monomers called

A. nitrogenoous bases.

B. amino acids.

C. simple sugars.

D. viamins.

34. A polypeptide is a polymer made of _____ bonded together.

A. sugars

B. nucloetides

C. amino acids

D. proteins

35. Nuclear force acts between

A. protons and neutrons.

B. protons and electrons.

C. electrons and neutrons.

D. protons, neutrons, and electrons.

36. The strong nuclear force

A. causes nuclear decay.

B. causes repulsion between protons.

C. overcomes attraction between protons and neutrons.

D. overcomes electrostatic repulsion between protons.

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37. The process of the production of lighter nuclei from heavier nuclei is called
    A. mass energy.
    B. fusion.
    C. magneticism.
    D. fission.

38. $E = mc^2$ is used to determine the
    A. speed of light in the reaction.
    B. alpha emission of an element.
    C. energy released in a nuclear reaction.
    D. number of half lives of an element.

39. The large amount of energy released during nuclear reactions comes from
    A. the conversion of matter into energy.
    B. the breaking of chemical bonds.
    C. the release of radioactive particles.
    D. electron to electron interactions.

40. Atoms with the same atomic number, but a different atomic mass, are known as
    A. alpha particles.
    B. nucleons.
    C. ions.
    D. isotopes.

41. Which of these represents a pair of isotopes?
    A. $^{122}_{54}\mathrm{Te}$; $^{122}_{52}\mathrm{Te}$
    B. $^{122}_{54}\mathrm{Te}$; $^{124}_{52}\mathrm{Te}$
    C. $^{122}_{54}\mathrm{Te}$; $^{124}_{54}\mathrm{Te}$
    D. $^{122}_{54}\mathrm{Te}$; $^{122}_{54}\mathrm{Te}^{2+}$

42. Alpha particles
    A. are positively charged.
    B. consist of two protons and four neutrons.
    C. can penetrate any thickness of matter.
    D. All of the above

43. The type of nuclear radiation that can penetrate farthest through matter is called
    A. radons.
    B. gamma rays.
    C. neutron emission.
    D. X rays.

44. The process of nuclear change in an atom of radioactive material is called
    A. nuclear decay.
    B. isotopes.
    C. nuclear mass.
    D. radon.

45. A beta particle is given the symbol (degree)-1(beta) When a radioactive element decays by emitting a beta particle, what change occurs within its nucleus? The number of
    A. protons decreases by 1.
    B. protons increases by 1.
    C. nucleons decreases by 1.
    D. neutrons increases by 1.

46. What particle is emitted in alpha radiation?
    A. electron
    B. photon
    C. helium nucleus
    D. hydrogen nucleus

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47. ${}^{127}_{52}\text{Te} \rightarrow {}^{123}_{50}\text{Sn} + \_\_\_\_\_$ What type of decay is this and what particle is emitted?

A. Alpha; ${}^{0}_{-1}\text{e}$

B. Beta; ${}^{0}_{-1}\text{e}$

C. Alpha; ${}^{4}_{2}\text{He}$

D. Beta; ${}^{4}_{2}\text{He}$

48. ${}^{14}_{6}\text{C} \rightarrow {}^{14}_{7}\text{N} + \_\_\_\_\_$ What type of decay is this and what particle is emitted?

A. Alpha; ${}^{0}_{-1}\text{e}$

B. Beta; ${}^{0}_{-1}\text{e}$

C. Alpha; ${}^{4}_{2}\text{He}$

D. Beta; ${}^{4}_{2}\text{He}$

49. What daughter isotope is produced in the nuclear decay shown? ${}^{218}_{84}\text{Po} \rightarrow {}^{0}_{-1}\text{e} + \_\_\_\_\_$

A. ${}^{217}_{84}\text{Po}$

B. ${}^{218}_{85}\text{At}$

C. ${}^{218}_{83}\text{Bi}$

D. ${}^{217}_{83}\text{Bi}$

50. Beta radiation can be blocked by

A. cardboard.

B. paper.

C. skin.

D. wood.

51. Arrange the forms of radiation from longest to shortest penetration range.

A. alpha, beta, gamma

B. alpha, gamma, beta

C. gamma, alpha, beta

D. gamma, beta, alpha

52. Radioactive elements are the sources of high energy particles such as alpha and beta particles, and gamma radiation. Alpha radiation has the least potential penetrating power of the three types of radiation because it

A. travels at high speed.

B. travels at the lowest speed.

C. has the greatest mass and a postive charge.

D. has the smallest mass and no charge.

53. The most penetrating form of radiation is

A. ultra violet.

B. alpha.

C. beta.

D. gamma.

54. When a nucleus undergoes nuclear decay by gamma rays, the atomic number of the element

A. remains the same.

B. increases by one.

C. decreases by one.

D. increases by two.

55. In alpha decay, the mass number of the atom before the decay

A. equals the sum of the mass numbers of the products.

B. does not change after the decay.

C. is the same as the atomic number.

D. cannot be determined.

56. Which of the following formulas represents a covalent compound?

A. CS_2

B. BaI_2

C. Xe

D. BeF_2

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57. Which element would form an ionic bond with fluorine (F)?
    A. carbon (C)
    B. oxygen (O)
    C. neon (Ne)
    D. copper (Cu)

58. In which type of bond do atoms share electrons?
    A. covalent bonds
    B. metallic bonds
    C. ionic bonds
    D. polyatomic bonds

59. Which of the following compounds contains covalent bonds?
    A. NaCl
    B. NH_3
    C. K_2S
    D. Li_3N

60. Ionic bonds form when two atoms
    A. exchange outer shell electrons.
    B. exchange inner shell electrons.
    C. share inner shell electrons.
    D. share outer shell electrons.

61. Which of the following statements is true concerning molecular compounds?
    A. They are composed of only one element.
    B. They are composed of ions.
    C. They are formed from a metal and a non metal.
    D. They are composed of two non metals.

62. An ionic bond involves
    A. sharing of electrons.
    B. exchange of electrons.
    C. sharing of metallic bonds.
    D. exchange of protons.

63. Which of these would NOT form a covalent bond?
    A. CH_4
    B. NH_3
    C. Na_2O
    D. CO_2

64. Ionic compounds are held together by
    A. the sharing of electrons.
    B. electrostatic attractions.
    C. intermolecular forces.
    D. the exchange of protons.

65. An ionic compound consists of positvie and negative ions which
    A. are a series of molecules.
    B. are a sea of electrons.
    C. form an octet.
    D. form a crystal lattice.

66. Compared with solids, liquids
    A. have their volume less affected by pressure.
    B. have less space between the particles that make them up.
    C. consist of particles less attracted to each other.
    D. are much more dense than solids.

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67. In order to melt ice, the kinetic energy of the water molecules must be great enough to break the
    A. covalent bonds between hydrogen (H) and oxygen (O).
    B. ionic bonds between hydrogen (H) and oxygen (O).
    C. intermolecular forces of attraction between molecules.
    D. covalent bonds between molecules.

68. The process of a liquid becoming a gas is called
    A. sublimation.
    B. condensation.
    C. evaporation.
    D. freezing.

69. The process of a liquid becoming a solid is called
    A. condensation.
    B. freezing.
    C. evaporation.
    D. melting.

70. The change of a substance from a solid directly to a gas is called
    A. condensation.
    B. evaporation.
    C. melting.
    D. sublimation.

71. Evaporation refers to the change of state from a
    A. liquid to a gas.
    B. gas to a liquid.
    C. solid to a liquid.
    D. liquid to a solid.

72. Which of these molecules have hydrogen bonds? 1. CH_4 2. HF 3. CH_3OH
    A. 1
    B. 2
    C. 1 & 2
    D. 2 & 3

73. Which of these would have the highest melting point due to the strong intermolecular forces?
    A. CH_4
    B. NH_3
    C. H_2
    D. CO_2

74. Chemical equations are balanced to show they obey the law of
    A. conservation of matter.
    B. conservation of energy.
    C. definite proportions.
    D. multiple proportions.

75. A chemical equation is balanced by changing or adding
    A. chemical symbols.
    B. subscripts.
    C. coefficients.
    D. reactants.

76. All of the following factors may speed up a chemical reaction *except*
    A. smaller surface area.
    B. higher pressure.
    C. higher temperature.
    D. presence of a catalyst.

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77. When this equation is correctly balanced, the coefficient for $AlCl_3$ is Al (s) + HCl (aq) --> $AlCl_3$ (aq) + H_2 (g)

A. 1

B. 2

C. 3

D. 6

78. What are the missing coefficients for the balanced equation? __Na+__O_2 --> __Na_2O

A. 1, 1, 1

B. 2, 1, 2

C. 4, 1, 2

D. 1, 2, 1

79. The coefficients in a balanced chemical equation can be used as a ratio of which of the following quantities? I. moles II. grams III. particles

A. I only

B. I and II

C. I and III

D. I,II and III

80. The atomic mass given on the periodic table represents the

A. mass of an individual atom of that element.

B. weighted average of all isotopes.

C. mass of the most abundant isotope.

D. average of the isotopes and ions of that element.

81. A mole is a number equal to the number of carbon atoms in exactly 12 grams of Carbon-12 (^{12}C). This number is

A. 12.0.

B. $5.02 \cdot 10^{22}$.

C. $6.02 \cdot 10^{23}$.

D. $1.20 \cdot 10^{24}$.

82. Counting the number of atoms is done using the fact that 6.02×10^{23} particles is equal to one

A. liter.

B. gram.

C. mole.

D. atom.

83. A mole is an SI base unit that describes the

A. mass of a substance.

B. amount of a substance.

C. volume of a substance.

D. electric charge of a substance.

84. Molar mass is defined as

A. the number of particles in 1 mole of a substance.

B. the SI base unit that describes the amount of a substance.

C. the amount of a substance necessary to have a positive charge.

D. the mass in grams of 1 mole of a substance.

85. You have 6.50 mol of chromium, which has a molar mass of approximately 52 g/mol. What is the mass in grams of this amount of chromium?

A. 3.38 g

B. 33.8 g

C. 338 g

D. 3.38 kg

86. Use the periodic table to calculate the molar mass of sodium hydroxide (NaOH).

A. 3 g

B. 20 g

C. 31 g

D. 40 g

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87. A sample of hydrogen gas (H_2) has a volume of 8.56 L at the standard temperature and pressure (0°C and 1 atm). How many moles of gas are present in this sample?

A. 0.03 mol

B. 0.38 mol

C. 8.56 mol

D. 104.31 mol

88. How many moles of CO are in 2.4×10^{24} molecules?

A. 0.25

B. 4.0

C. 38

D. 6.02×10^{23}

89. What is the volume in liters of 2 moles of carbon dioxide of STP?

A. 0.089 L

B. 11.2 L

C. 44.8 L

D. 12.04×10^{23} L

90. In the balanced equation, $H_2 + Cl_2$ ---> 2HCl, 2.0 grams of hydrogen (H_2) would require how many grams of chlorine (Cl_2) to completely react?

A. 2.0 grams

B. 35.5 grams

C. 37.5 grams

D. 71.0 grams

91. How many grams of nitrogen are needed to produce 68.1 grams of ammonia (NH_3). $N_2 + 3H_2$ --> $2NH_3$

A. 28 grams

B. 56 grams

C. 112 grams

D. 224 grams

92. A reaction that was expected to produce 30.grams of aluminum chloride only produces 25 grams. What is the percent yield?

A. 0.83%

B. 1.2%

C. 83%

D. 120%

93. As molecules collide with the surface of a container, they create

A. density.

B. potential energy.

C. pressure.

D. mass.

94. A can filled with air is heated to force some the air out of the can. When the can is capped and cooled it will crush because the pressure inside has _____ due to _____ molecules colliding against the surface

A. increased; more

B. decreased; more

C. increased; fewer

D. decreased; fewer

95. When a fixed sample of gas increases in volume, it must also

A. decrease in pressure.

B. increase in temperature.

C. Either (a) or (b)

D. Both (a) and (b)

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96. A bottle of sweet smelling ester was opened and in a short period of time the ester smell was detected across the room. This is due to the odor molecules

A. being heavier than air and sinking to the floor.

B. being lighter than air and rising to the ceiling.

C. moving from low concentration to high concentration.

D. moving randomly and diffusing across the room.

97. Sulfur trioxide (SO_3) and oxygen (O_2) were released at opposite ends of a glass tube. The gases will diffuse toward the middle of the tube because the molecules are

A. in constant random motion.

B. attracted to each other.

C. repelled by the air.

D. moving to a higher concentration.

98. A protein is a polymer that is made of

A. simple sugars.

B. nitrogen and carbon dioxide.

C. amino acids.

D. DNA.

99. A sealed piston holds 22.4 L of gas at 2.00 atm, 0.0◦C. If the piston is allowed to expand to 44.8 L what is the final pressure assuming the final temperature is 273◦C?

A. 0.500 atm

B. 1.00 atm

C. 2.00 atm

D. 4.00 atm

100. A balloon is inflated to 100.0L at 1.00 atm, 27.0◦C. The balloon rises to an altitude of 10,000 meters where the temperature is 150.0 K and the pressure is 0.500 atm. What is the volume of the balloon?

A. 25.0 L

B. 50.0 L

C. 100. L

D. 200. L

101. A balloon at 1.00 atm pressure, 27◦C holds 12.0 L of gas. The balloon is submerged in a liquid such that the pressure is 1.50 atm and the volume drops to 4.00 L. What is the temperature of the liquid?

A. 50 K

B. 150 K

C. 300 K

D. 600 K

102. A sample of gas occupies 250 mL at STP. What is the temperature if the gas expands to 1500 mL at a pressure of 0.500 atm?

A. -60.0◦C

B. 0.0◦C

C. 273◦C

D. 546◦C

103. As the temperature of a fixed amount of gas at constant volume decreases, its pressure

A. decreases.

B. stays the same.

C. increases.

D. None of the above

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104. As the volume of a fixed amount of gas at constant temperature decreases, its pressure
   A. decreases.
   B. stays the same.
   C. increases.
   D. Insufficent data to answer question

105. Scuba divers use a mixture of helium (He) and oxygen (O_2) gases in their "air" tanks during deep dives. 14 liters of oxygen gas and 46 liters of helium gas, both at 25degrees Celsius and 1.0 atm, are pumped into a 5.0 liter tank. What is the total pressure of the two gases in the tank, at 25degrees Celsius?
   A. 0.083 atm
   B. 2.0 atm
   C. 5.0 atm
   D. 12.0 atm

106. What is the temperature under the condition referred to as STP?
   A. 0 K
   B. 273 K
   C. 273◦ C
   D. 546◦ C

107. What is the pressure under the condition referred to as STP?
   A. 1 mm Hg
   B. 1 torr
   C. 670 mm Hg
   D. 760 mm Hg

108. In order to change Celsius into Kelvin, you must
   A. add 100 to Celsius.
   B. subtract 100 from Celsius.
   C. add 273 to Celsius.
   D. subtract 273 from Celsius.

109. In Antarctica, the temperature can get as low as -60◦C. In Kelvin, this temperature would be
   A. 177 K.
   B. 213 K.
   C. 297 K.
   D. 333 K.

110. If all atomic and molecular motion stopped, the substance would be at
   A. standard temperature, 0^oC.
   B. standard temperature, 273 K.
   C. absolute zero, 0^oC.
   D. absolute zero, 0 K.

111. For an ideal gas, the average kinetic energy is
   A. directly proportional to its Kelvin temperature.
   B. inversely proportional to its Kelvin temperature.
   C. directly proportional to its pressure.
   D. inversely proportional to its pressure.

112. Temperature is
   A. associated with the sensation of hot and cold.
   B. proportional to the average kinetic energy of molecules.
   C. measured with thermometers.
   D. All of the above

113. At 1 atm 5 moles of hydrogen (H2) has a volume of 500 mL at what temperature?
   A. 1.22 K
   B. 122 K
   C. 907 K
   D. 9.07×10^5 K

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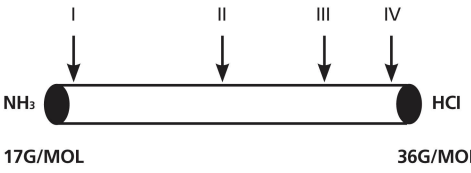
114. 

A cotton ball is saturated with ammonia, NH_3 and placed at one end of a glass tube. A second cotton ball is saturated with hydrochloric acid, HCl and placed at the other end of the tube. The two gases diffuse and upon meeting, create the white vapor ammonium chloride, NH_4Cl. Where in the tube will the white vapor be seen first?

A. location I

B. location II

C. location III

D. location IV

115. Acids are substances that

A. form hydronium ions when dissolved in water.

B. turn red litmus paper blue.

C. make foods taste bitter.

D. react with neutral liquids to form bases.

116. When dissolved in water, all acids will

A. form hydroxide ions.

B. have a negative charge.

C. conduct electricity.

D. turn blue.

117. When a solution of an acid reacts with a solution of a base, hydronium ions react with hydroxide ions to form

A. a salt.

B. a stronger acid.

C. a weaker base.

D. water.

118. Which of the following is a basic solution?

A. household ammonia

B. HCl dissolved in water

C. vinegar

D. pure water

119. A solution that is a base will

A. not conduct electricity.

B. turn phenolphthalein pink.

C. taste sour.

D. bubble when added to baking soda.

120. Ions that do not change during a chemical reaction are called

A. spectator ions.

B. hydroxide ions.

C. monatomic ions.

D. hydronium ions.

121. An unknown green solution was found during a laboratory experiment. The following observations were made: it bubbled when dripped on zinc and turned litmus paper red. This solution is a(n)

A. acid.

B. base.

C. salt.

D. metal.

122. Which statement about bases is *incorrect* ?

A. All bases turn red litmus paper blue.

B. All bases contain hydroxide ions.

C. All bases taste bitter.

D. All bases feel slippery.

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123. A Bronsted base is a substance that
   A. accepts a hydrogen ion (H+).
   B. donates a hydrogen ion (H+).
   C. accepts a hydroxide ion (OH-).
   D. donates a hydroxide ion (OH-).

124. A substance that accepts hydrogen ions (H^+) is classified as
   A. an acid.
   B. a base.
   C. a salt.
   D. an electrolyte.

125. A substance which partially dissociates in water to produce H^+ ions should be classified as a
   A. weak acid.
   B. weak base.
   C. strong acid.
   D. strong base.

126. A strong acid is one which
   A. has a pH less than 5.
   B. completely dissociates in water.
   C. fully neutralizes a base.
   D. has a concentration greater than 1M.

127. What is the pH of a solution that results from complete neutralization of a HCl (acid) with a KOH solution?
   A. 1
   B. 7
   C. 10
   D. 14

128. The pH of a substance is a measure of its
   A. boiling point.
   B. food value.
   C. ability to mix with water.
   D. hydronium ion concentration.

129. A heterogeneous mixture is one that is *not*
   A. uniform throughout.
   B. easily mixed together.
   C. made of two or more liquids.
   D. edible by humans.

130. Which statement about solutions is *incorrect* ?
   A. Liquids that mix to form a single layer are said to be miscible.
   B. Solutions can be made of liquids and solids, liquids and liquids, or gases and liquids.
   C. In a solution, the solvent is dissolved into the solute.
   D. Solutions will not separate under normal circumstances.

131. An example of a nonpolar molecule is
   A. water.
   B. vinegar.
   C. olive oil.
   D. table salt.

132. Dentists use mixtures of liquid mercury (Hg) and solid silver (Ag) for fillings in teeth. A typical composition is 4.0 grams mercury and 50.0 grams of silver. The mercury would be called the
   A. solvent.
   B. solution.
   C. solute.
   D. dissolving medium.

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133. Heating a solvent usually increases the speed of solubility because

A. it increases the kinetic energy of the molecules.

B. boiling breaks up large particles.

C. dissolving is an exothermic process.

D. it increases the polarity of the solvent.

134. The dissolving process includes

A. random particle size of the solute.

B. random molecular motion of the solute.

C. random molecular motion of the solvent.

D. random particle size of the solvent.

135. Because silver chloride, AgCl, is almost completely insoluble in water, the forces between the ions in a crystal of AgCl must be

A. nonpolar.

B. partially covalent.

C. extremely strong.

D. weaker than those in a water molecule.

136. All of the following will make it easier to dissolve a solute in a solvent *except*

A. heating the solvent.

B. stirring the solution.

C. increasing the surface area of the solute.

D. adding a larger amount of solute.

137. Loose sugar dissolves much faster than a sugar cube because loose sugar has

A. a greater surface area.

B. less kinetic energy.

C. a higher temperature.

D. a greater surface tension.

138. The mass of calcium ion, Ca^{2+}, in a solution is 3.5 g per 100 g of solution. Calculate the parts per million of Ca^{2+} in solution.

A. 350 ppm

B. 3,500 ppm

C. 35,000 ppm

D. 3,500,000 ppm

139. Determine the molarity of a glucose ($C_6H_{12}O_6$) solution made by dissolving 36g of glucose in 2.0 L of solution.

A. 0.1 M

B. 1.0 M

C. 2.5 M

D. 18 M

140. Which is the most concentrated solution of sodium sulfate, Na_2SO_4 ?

A. 1.0 M Na_2SO_4

B. 2.0 M Na_2SO_4

C. 3.0 M Na_2SO_4

D. 4.0 M Na_2SO_4

141. Parts per million (ppm) is a unit of concentration often used when measuring levels of pollutants in air, water, or body fluids. One ppm is 1 part in 1,000,000. The common unit _____ is equal to ppm.

A. mg/L

B. g/L

C. mg/mL

D. g/mL

142. Molality (m) is defined as the

A. moles solute/liter of solvent.

B. moles solute/kg solvent.

C. moles solute/kg solution.

D. grams solute/mole solvent.

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143. Heat involves the transfer of energy between two objects that are at different temperatures. When a metal object is first heated, then submerged in cooler water, the water will _____ in temperature and the metal will _____ in temperature.

A. decrease; remain the same

B. increase; remain the same

C. increase; decrease

D. decrease; decrease

144. When a substance increases in temperature, the particles

A. move more rapidly.

B. expand in size.

C. change phase.

D. decrease in entropy.

145. In an exothermic reaction, the heat of the reaction is always

A. very small.

B. zero.

C. positive.

D. negative.

146. In an exothermic reaction, the heat content of the reactants compared to that of the product is

A. always lower.

B. always higher.

C. always equal.

D. either higher or lower.

147. In an endothermic reaction, the potential energy of the reactants is

A. higher than that of the products.

B. equal to that of the products.

C. lower than that of the products.

D. released to the surroundings.

148. Which describes an endothermic process?

A. an ice cube melting in a glass of warm soda

B. natural gas burning in the furnace of a house

C. dissolving of CaCl2 in water, making the solution warmer

D. a firecracker exploding

149. Which describes an exothermic process?

A. dissolving KNO_3 in water, making the solution colder

B. the combustion of gasoline in a car engine

C. dry ice subliming, CO_2 (s) + energy ----> CO_2 (g)

D. your body in a hot Jacuzzi spa

150. How much energy does it take to turn 100 grams of water (H_2O) at 100℃ into steam at 100℃? (the heat of vaporization of water is 2260 joules per gram)

A. 2260 joules

B. 2360 joules

C. 226,000 joules

D. 2,260,000 joules

151. How much energy is released when 10.0 grams of water at 0^o freezes into ice? (latent heat of fusion of ice is 334 J/g)

A. 33.4 joules

B. 344 joules

C. 3340 joules

D. 33400 joules

152. Specific heat is the amount of energy required to

A. raise 1 gram of a substance 1 degree.

B. change 1 gram of a solid into a liquid.

C. change 1 gram of a liquid into a gas.

D. ionize 1 gram of a substance.

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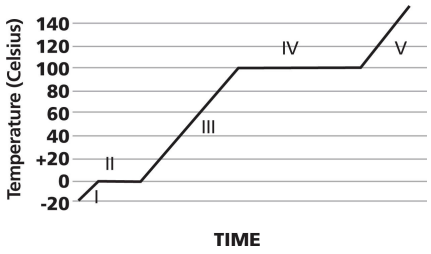
153. During which portion of the graph is a phase change occurring?



A. I and III

B. I, III, and V

C. II and IV

D. III, IV, and V

154. Rate can be determined by I. measuring change in concentration of products and change in time. II. measuring change in concentration of reactant and change in time. III. measuring amount of reactant started with and change in time. IV. measuring change of volume of gas generated and change in time

A. I, III, and IV

B. I, II, and III

C. I, II, and IV

D. I, II, III, and IV

155. Metallic silver is produced in the following reaction: $2AgNO_3$ (aq) + Cu (s) ----> 2Ag (s) + $Cu(NO_3)_2$ (aq). In order to increase the rate at which silver (Ag) is produced, you could

A. use a lower M AgNO3 solution.

B. warm the AgNO3 solution.

C. increase the pressure on the reaction mixture.

D. decrease the surface area of the Cu.

156. Which of these statements about reaction rate is TRUE?

A. Increasing the temperature increases the rate of reaction because particles move faster at higher temperatures.

B. Increasing temperature decreases the rate of reaction because fewer collisions occur at higher temperatures.

C. Decreasing the temperature increases the rate of reaction because particles are closer together at lower temperatures.

D. The number of collisions per unit time is not affected by temperature.

157. Which set of conditions will decrease the rate at which 5.0 grams of iron (Fe) react with copper (II) chloride ($CuCl_2$)? The equation for the reaction is shown below. Fe (s) + $CuCl_2$ (aq) --> Cu (s) + $FeCl_2$ (aq)

A. Decrease the pressure on the $CuCl_2$ solution.

B. Use a higher molarity of $CuCl_2$ solution.

C. Heat the $CuCl_2$ solution to 30℃.

D. Use one chunk of iron rather than iron powder.

158. A catalyst increases the rate of a chemical reaction by

A. providing a reaction pathway with a lower activation energy.

B. increasing the activation energy required for the reaction.

C. decreasing the number of efficient collisions.

D. increasing the speed of reactant molecules.

159. Some a catalysts affect the rate of a reation by?

A. holding reactant molecules in favorable positions

B. increasing the number of collision

C. providing more energy for the reactants

D. increasing the activation energy

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160. A catalyst _____ the reaction rate _____ being used up during the process.

A. increases; while

B. increases; without

C. decreases; without

D. decreases; while

161. The energy required to start a reaction is called

A. kinetic energy.

B. reaction energy.

C. activation energy.

D. potential energy.

162. $N_2(g) + 3H_2(g) <--> 2NH_3(g)$ How will an increase in pressure affect the reaction above?

A. The reaction will shift to the left.

B. The reaction will shift to the right.

C. There will be no effect on the reaction.

D. The reaction rate will increase.

163. What will increase the forward direction of this reaction? $CaCO_3(s) <--> CaO(s) + CO_2(g)$

A. high pressure

B. low pressure

C. increasing the concentration of CaO

D. decreasing the amount of $CaCO_3$

164. When SO_3 decomposes it established equilibrium with SO_2 and O_2. $2SO_3\ (g) + \text{heat} <----> 2SO_2\ (g) + O_2\ (g)$ Decreasing the temperature will cause

A. no change in equilbrium.

B. an increase in $[SO_3]$.

C. an increase in $[SO_2]$ and $[O_2]$.

D. an increase in all concentrations.

165. $2NO_2(g) \leftrightarrows N_2O_4(g) + 57.2\ kJ$
(brown) (colorless)
In order to turn the solution colorless, (shift to the right) which of the following could be done?

A. decrease the amount of NO_2

B. cool the solution

C. heat the solution

D. decrease the pressure

166. Many chemical reactions are reversible. Which of the following is true of all chemical reactions in which equilibrium has been reached?

A. The forward reaction ceases.

B. The concentrations of the reactants and products are equal.

C. The reverse reaction begins.

D. The rate of the forward and reverse reactions are equal.

Stop! You have finished this exam.