

Semester 1

Final Exam Review Questions

Introductory Concepts

- Chemistry is best defined as the study of _____.
- Chemistry is called the central science because it _____.
- The factor being tested in an experiment is called the _____.
- A statement that describes how nature behaves but does not explain why it behaves that way is called a(n): _____.
- An experimental control does what? _____.

SI System						
Measure	Length	Time	Mass	Current	Amount	Temperature
Base Unit						
Prefix	kilo-	hecto-	deka-	deci-	centi-	milli-
Value						

- Which instrument used to measure liquid volume precisely in the lab? _____.
- How many joules are in 1kJ? _____.
- How many millimeters are in 1m? _____.
- Density = _____.
- _____ is anything that occupies space and has mass.
- The first step in the scientific method is _____.
- Compare accuracy and precision of a measurement. _____.
- _____
- Why is it necessary to perform multiple trials of a scientific experiment? _____.
- What type of instrument is best for measuring mass, volume, and length? _____.
- _____
- How many significant figures are in the following measurements?

a. 0.000653 g _____	d. 0.00200 mL _____
b. 1200. m _____	e. 24 000 mL _____
c. 8.50×10^{-9} m _____	f. 0.025 060 s _____

Matter

- A blend of two or more pure substances is called a(n) _____.
- _____ is the state of matter characterized by definite volume, but lack of definite shape.
- A substance that contains two or more elements chemically combined in a fixed proportion is called a(n) _____.
- _____ and _____ are the two types of pure substances.
- A substance that cannot be separated into simpler substances by a chemical change is called a(n) _____.
- The temperature at which all motion stops in a sample of matter is referred to as _____.
- A combination of oil and vinegar is a(n) _____ mixture.
- Salt dissolved in water is an example of a(n) _____ mixture.
- A(n) _____ is a combination of two or more substances in which each substance retains its properties.
- The rusting of a nail is an example of a(n) _____ change.
- The fact that water boils at 100°C is an example of a(n) _____ property.
- A substance that is yellow at room temperature is heated over a flame and turns a bright orange. Upon cooling the substance returns to its original yellow color. This type of change is a(n) _____ change.
- A material that contains only one type of atom is referred to as a(n) _____.
- The compound $C_6H_{12}O_6$ has a total of _____ atoms.

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30. Liquid mixtures may be separated by using distillation which takes advantage of difference in the _____ of mixed substances.
31. When dissolved solids are separated from a solution by boiling the solution away it is called _____.

Atomic Structure

32. The 3 primary parts of the atom are the _____.
33. The negative region of the atom is the _____.
34. The positive region of the atom is the _____.
35. Describe the gold foil experiment. What was the important discovery in that experiment? _____
- _____
- _____

36. The _____ of the atom makes up the mass of the atom.
37. The _____ of the atom makes up the volume of the atom.
38. What is atomic number? _____
39. What is atomic mass? What two subatomic particles make up the majority of an atom's mass? _____
- _____

40. A(n) _____ is an atom that has gained or lost electrons.
41. _____ are atoms of the same element that have different numbers of neutrons.
42. Zn^{2+} has _____ protons, _____ neutrons and _____ electrons.
43. O^{2-} has _____ protons, _____ neutrons and _____ electrons.
44. Au has _____ protons, _____ neutrons and _____ electrons.
45. Determine the number of protons, neutrons, and electrons in each atom or ion:

- a. ${}_{40}^{91}\text{Zr}$ Protons: _____ Neutrons: _____ Electrons: _____
- b. ${}_{51}^{122}\text{Sb}$ Protons: _____ Neutrons: _____ Electrons: _____
- c. ${}_{80}^{200}\text{Hg}^{2+}$ Protons: _____ Neutrons: _____ Electrons: _____
- d. ${}_{15}^{31}\text{P}^{3-}$ Protons: _____ Neutrons: _____ Electrons: _____

46. The force that holds the nucleus of an atom together is called _____.
47. The force that causes the nucleus to be unstable is called _____.
48. List the two types of radiation that are particles. _____ & _____
49. The smallest particle of radiation is the _____.
50. List the three types of radiation in order of ability to penetrate. (Least to Most)
Least: _____ Most: _____
51. Gamma radiation can best be described as a _____.
52. When the nucleus of an atom is split, it is called _____
53. Write the formula for an isotope that has 92 protons, 143 neutrons, and 90 electrons

54. If element X has a half-life of 20 years and you have 2g now, how much would have been present 140 years ago?
55. If a 1.0g sample of ancient wood has $1/8^{\text{th}}$ the radioactivity of a 1.0g modern sample of the same wood, how old is the ancient wood. Half-life of carbon 14 = 5730 years.
56. An _____ specifies a volume of space where an electron is likely to be found 90% of the time.
57. Describe the energy level with the principal quantum number $n = 1$. _____
- _____
58. Why can't electrons exist between energy levels in an atom? _____
- _____

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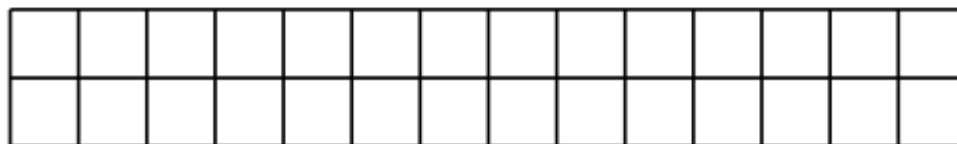
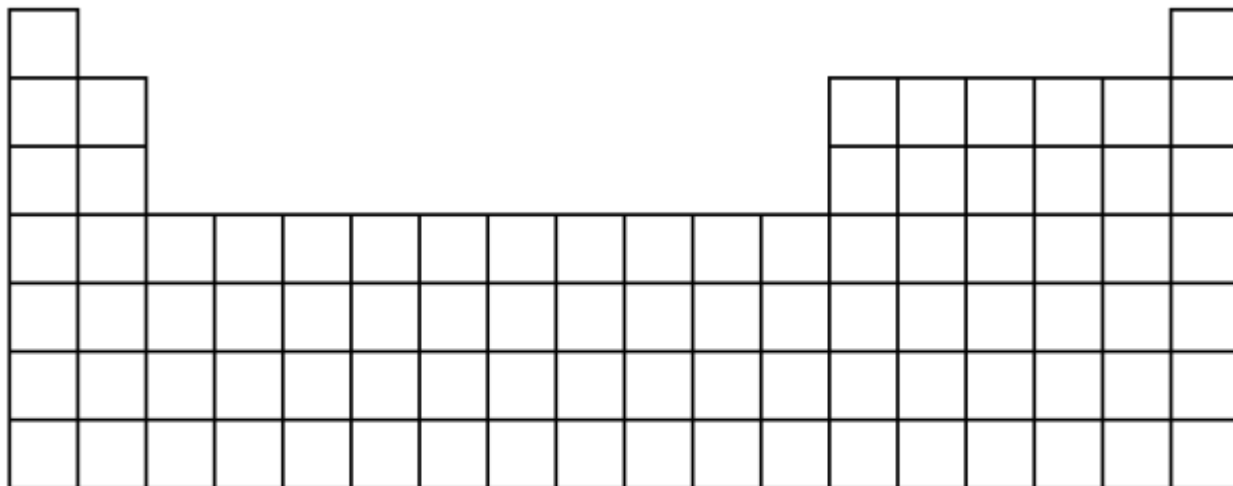
59. Compare the wavelengths and frequencies of gamma rays, visible light and radio waves. Which has the most the energy?

60. What happens to electrons in an atom when they gain energy? What happens to electrons in an atom when they lose energy? _____

61. Identify the s,p,d and f blocks of the periodic table.

62. Where are the metals, nonmetals, and semimetals on the periodic table?

63. Identify the groups for alkali metals, alkaline earth metals, halogens, and transition metals?



64. Why do elements in the same group (family) have similar properties? _____

65. Write electron configurations for the following box orbital diagrams.

1s	2s	2p(x)	2p(y)	2p(z)	3s	3p(x)	3p(y)	3p(z)	Configuration

66. Draw a Bohr model for the first three atoms of the alkali metals, alkaline earth metals and boron families. Alkali metals form ions with a 1+ charge, alkaline-earth metals form ions with 2+ charge and boron family ions have 3+ charge. What does the charge have to do with the models?

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67. Why do halogens all have a charge of 1- and oxygen family elements have a charge of 2-? _____

68. Why can't you necessarily use an electron configuration to identify an element? _____

69. Why do electrons initially spread out into separate orbitals when filling in orbitals of equal energy? _____

70. State the definition and trend for ionization energy. _____

71. State the definition and trend for electronegativity. _____

72. State the definition and trend for the size of atoms. _____

73. State the trends for the relative sizes of ions to atoms. _____

74. Which family of elements has the highest ionization energies? _____ Why? _____

75. Which family of elements has the lowest ionization energies? _____ Why? _____

76. Complete the following nuclear decay reactions:
- a. ${}_{88}^{218}\text{Ra} \rightarrow \underline{\hspace{1cm}} \underline{\hspace{1cm}} + {}_{-1}^0\text{e}$
- b. ${}_{92}^{238}\text{U} \rightarrow \underline{\hspace{1cm}} \underline{\hspace{1cm}} + {}_{90}^{234}\text{Th}$
- c. ${}_{6}^{14}\text{C} \rightarrow {}_{7}^{14}\text{N} + \underline{\hspace{1cm}} \underline{\hspace{1cm}}$
- d. $\underline{\hspace{1cm}} \underline{\hspace{1cm}} \rightarrow {}_{2}^4\text{He} + {}_{82}^{214}\text{Pb}$
77. What is the strong nuclear force? _____
78. What is the equation that allows us to calculate the energy released in nuclear reactions? _____
79. What are the three most common forms of radioactive decay? Describe each type of decay. How does the nucleus change with each type of decay?
- a. _____

- b. _____

- c. _____

80. How does the energy release in a nuclear reaction compare to the energy release in a chemical reaction? _____

Bonding

81. The first valence shell holds _____ electrons.
82. The second valence shell holds _____ electrons.
83. Which family of elements has the lowest ionization energies? _____
84. Non-metals have high / low ionization energies and high / low electron affinities.
85. Metals have high / low ionization energies and high / low electron affinities.
86. What are the general rules that apply to determining electronegativity of elements using the periodic table? _____

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87. Up to how many electrons are drawn on each side of the atomic symbol in a Lewis structure? _____

88. Draw a Lewis structure for the following atoms or ions.

a. C

b. O

c. O^{2-}

d. H

e. H^{-}

f. He

89. How many electrons do the following atoms have available for bonding:

a. I _____

c. Ca _____

e. Sb _____

g. S _____

b. H _____

d. Al _____

f. Rb _____

h. C _____

90. How many covalent bonds does C form? _____

91. How many valence electrons does:

a. the halogen family have? _____

c. the oxygen family? _____

b. the boron family? _____

d. the carbon family? _____

92. How many bonding sites do the halogens have? _____ What about members of the nitrogen family? _____

93. Why is an ion of sodium (Na^{+}) safe to eat, but an atom of sodium (Na) isn't? _____

94. What will be the most likely ion that the following atoms form:

a. Na _____

c. Mg _____

e. Al _____

b. P _____

d. Br _____

f. S _____

95. Define the octet rule. _____

96. What is a covalent bond? _____

a. What types of elements form covalent bonds? _____

b. How is the octet rule satisfied? _____

c. What is the difference between polar and nonpolar covalent bonds? _____

97. What is an ionic bond? _____

a. What types of elements form ionic bonds? _____

b. How is the octet rule satisfied? _____

98. What is a metallic bond? _____

99. A(n) _____ bond is one in which two oppositely charged particles are drawn together by electrostatic forces.

100. A(n) _____ bond occurs when two atoms of similar electron affinity and ionization energy fight over electrons.

101. Electrons are easily stolen from metals because their _____ is relatively low when compared to non-metals.

102. Covalent bonds occur because atoms need to become stable by filling their _____.

103. Non-metals are able to steal a metal's electrons because non-metals have high _____.

104. A _____ covalent bond occurs when two atoms "share" two pairs of electrons.

105. An ionic bond occurs when electrons are stolen from _____ by non-metals.

106. What type of bond does a molecule have? _____

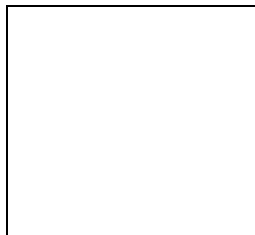
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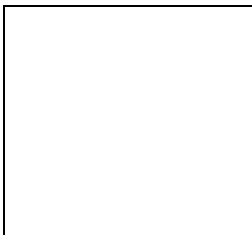
107. What type of bond does a salt crystal have? _____
108. What type of bond has a repeating pattern of positive and negative ions? _____ How are these ions held together? _____

109. Draw Lewis dot structures for the following:

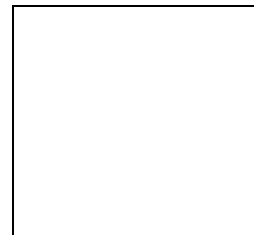
a. H_2O



b. CCl_4



c. PH_3



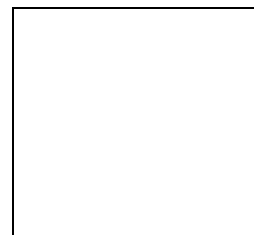
d. CO_2



e. Br_2



f. H_2SO_4



110. The octet rule states that elements form bonds in order to form a(n) _____.

111. When 3 pairs of electrons are shared by two atoms, you have a(n) _____.

112. What is VSEPR? What does it cause electron pairs to do in the valence shell? _____

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113. Rank the repulsion of the following electron pairs.

Pair Types	Shared – Shared	Shared – Unshared	Unshared – Unshared
Rank			

114. What 2 things help determine if a molecule is a polar molecule? _____

115. Rank the following bonds from most polar (5) to least polar (1).

Bond	B-C	C-F	N-F	B-N	B-F
Polarity Rank					

116. Which of the following would have the highest boiling point? (remember polar compounds have higher boiling points because they are “stickier”) N_2 , CO_2 , H_2O , BF_3 . _____

117. Label the ends of the following bonds as positive or negative.



118. Why is an ionic compound like NaCl more soluble in water than a covalent compound like CO_2 ? _____

119. What type of substance has a high melting point, conducts electricity in solution, but does not conduct electricity as a solid? _____

120. Write the formula for the following substances:

- | | |
|---------------------------------------|--------------------------------|
| a. calcium hydroxide _____ | e. sodium oxalate _____ |
| b. potassium hydrogen carbonate _____ | f. mercury (I) bromide _____ |
| c. silicon hexafluoride _____ | g. manganese (III) oxide _____ |
| d. dinitrogen tetroxide _____ | h. boron trifluoride _____ |

121. The force that holds water molecules together is a type of _____ force, called a _____ bond.

122. The phase change from solid to liquid is called _____. The phase change between liquid and solid is called _____. These two phase changes occur at the _____ temperature.

123. To cause something to freeze, _____ must be removed.

124. The phase change from liquid to gas is called _____. The phase change between gas and liquid is called _____.

125. When molecules lose _____ they get closer together allowing the hydrogen bonds to attract them together.

126. The boiling point of water at standard atmospheric pressure is _____ °C.

127. Whenever a phase change occurs between solid to liquid or liquid to gas it requires extra _____ to break the attractions between molecules.

128. Whenever a phase change occurs between gas to liquid, or liquid to solid, it gives off extra _____ to the surrounding environment.

129. Rank the following intermolecular forces from weakest (1) to strongest (4).

IMF	dipole-dipole	ion-dipole	induced dipole- induced dipole	induced dipole- permanent dipole
Rank				