Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) About 25 of the 92 natural elements are known to be essential to life. Which four of these 25 elements make up approximately 96% of living matter? 1) _____

A) oxygen, hydrogen, calcium, nitrogen
B) carbon, oxygen, nitrogen, calcium
C) carbon, hydrogen, nitrogen, oxygen
D) carbon, sodium, hydrogen, nitrogen
E) carbon, oxygen, phosphorus, hydrogen

2) Trace elements are those required by an organism in only minute quantities. Which of the following is a trace element that is required by humans and other vertebrates, but not by other organisms such as bacteria or plants? 2) _____

A) calcium
B) nitrogen
C) sodium
D) phosphorus
E) iodine

3) Which of the following statements is *false*? 3) _____

A) Virtually all organisms require the same elements in the same quantities.
B) Carbon, hydrogen, oxygen, and nitrogen are the most abundant elements of living matter.
C) Other than some trace elements, animals are mostly made up of the same elements as plants, in similar proportions.
D) Some trace elements are very abundant on Earth.
E) Iron is an example of an element needed by all organisms.

4) What factors are most important in determining which elements are most common in living matter? 4) _____

A) the reactivity of the elements with water
B) the relative abundances of the elements in Earth's crust and atmosphere
C) the chemical stability of the elements
D) the emergent properties of the simple compounds made from these elements
E) both the relative abundances of the elements and the emergent properties of the compounds made from these elements

5) Why is each element unique and different from other elements in chemical properties? 5) _____

A) Each element has a unique atomic weight.
B) Each element has different radioactive properties.
C) Each element has a unique atomic mass.
D) Each element has a unique number of neutrons in its nucleus.
E) Each element has a unique number of protons in its nucleus.

6) Knowing just the atomic mass of an element allows inferences about which of the following? 6) _____

A) the number of neutrons in the element
B) the number of protons plus neutrons in the element
C) the chemical properties of the element
D) the number of protons in the element
E) both the number of protons and the chemical properties of the element

7) In what way are elements in the same column of the periodic table the same? 7) _____

A) They have the same number of electrons.
B) They have the same number of electron shells.
C) They have the same number of protons.
D) They have the same number of electrons in their valence shell.
E) They have the same number of neutrons.

8) Oxygen has an atomic number of 8 and a mass number of 16. Thus, what is the atomic mass of an oxygen atom? 8) _____

A) exactly 8 daltons
B) approximately 16 daltons
C) exactly 8 grams
D) approximately 16 grams
E) 24 amu (atomic mass units)

9) The nucleus of a nitrogen atom contains 7 neutrons and 7 protons. Which of the following is a *correct* statement concerning nitrogen? 9) _____

A) The nitrogen atom has a mass number of approximately 7 daltons and an atomic mass of 14.
B) The nitrogen atom has a mass number of approximately 14 daltons and an atomic mass of 7.
C) The nitrogen atom has a mass number of 14 and an atomic mass of approximately 14 daltons.
D) The nitrogen atom has a mass number of 7 and an atomic number of 14.
E) The nitrogen atom has a mass number of 14 and an atomic mass of 7 grams.

10) Molybdenum has an atomic number of 42. Several common isotopes exist, with mass numbers of 92, 94, 95, 96, 97, 98, and 100. Therefore, which of the following can be *true*? 10) _____

A) The isotopes of molybdenum have between 50 and 58 neutrons and have different electron configurations.

B) Molybdenum atoms can have between 50 and 58 neutrons.

C) The isotopes of molybdenum can have between 50 and 58 protons.

D) The isotopes of molybdenum have between 50 and 58 protons and have different electron configurations.

E) The isotopes of molybdenum have different electron configurations.

11) Carbon-12 is the most common isotope of carbon, and has an atomic mass of 12 daltons. A mole of carbon in naturally occurring coal, however, weighs slightly more than 12 grams. Why? 11) _____

A) Some carbon atoms in nature have a different valence electron distribution.

B) Some carbon atoms in nature have undergone radioactive decay.

C) Some carbon atoms in nature have an extra proton.

D) The atomic mass does not include the mass of electrons.

E) Some carbon atoms in nature have more neutrons.

12) Which of the following best describes the relationship between the atoms described below? 12) _____

Atom 1	Atom 2
$^{1}_{1}H$	$^{3}_{1}H$

A) They are polymers.

B) They are isomers.

C) They each contain 1 neutron.

D) They contain 1 and 3 protons, respectively.

E) They are isotopes.

13) The precise weight of a mole of some pure elements like silicon (Si) can vary slightly from the standard atomic mass, or even from sample to sample. Why? 13) _____

A) The element may undergo radioactive decay.

B) The amount of energy absorbed by the element affects the mass of its electrons, and thus the atomic mass can vary slightly.

C) The element may have multiple stable isotopes, and the isotopic composition may vary from sample to sample.

D) The atoms of the element form chemical bonds with each other, and that changes the weight of the element.

E) The element may react with itself and gain or lose subatomic particles.

14) One difference between carbon-12 ($^{12}_{6}C$) and carbon-14 ($^{14}_{6}C$) is that carbon-14 has 14) _____

A) two more electrons than carbon-12.
B) two more protons than carbon-12.
C) two more protons and two more neutrons than carbon-12.
D) two more electrons and two more neutrons than carbon-12.
E) two more neutrons than carbon-12.

15) An atom has 6 electrons in its outer shell. How many unpaired electrons does it have? 15) _____

A) 0 B) 6 C) 4 D) 2 E) 2 or 4

16) The atomic number of nitrogen is 7. Nitrogen-15 is heavier than nitrogen-14 because the atomic nucleus of nitrogen-15 contains how many neutrons? 16) _____

A) 6 B) 7 C) 14 D) 8 E) 12

17) Electrons exist only at fixed levels of potential energy. However, if an atom absorbs sufficient energy, a possible result is that 17) _____

A) an electron may move to an electron shell closer to the nucleus.
B) the atom would become a positively charged ion, or cation, and become a radioactive isotope.
C) an electron may move to an electron shell farther away from the nucleus.
D) the atom may become a radioactive isotope.
E) the atom would become a negatively charged ion, or anion.

18) The atomic number of neon is 10. Therefore, which of the following is *most* correct about an atom of neon? 18) _____

A) It has 8 electrons in its outer electron shell and it is inert.
B) It has an atomic mass of 10 daltons.
C) It has 8 electrons in its outer electron shell, it is inert, and it has an atomic mass of 10 daltons.
D) It has 8 electrons in its outer electron shell.
E) It is inert.

19) From its atomic number of 15, it is possible to predict that the phosphorus atom has 19) _____

A) 15 electrons.
B) 15 protons.
C) 15 protons and 15 electrons.
D) 15 neutrons.
E) 8 electrons in its outermost electron shell.

20) Atoms whose outer electron shells contain 8 electrons tend to 20) _____

A) be stable and chemically nonreactive, or inert.
B) be both chemically inert and gaseous at room temperature.
C) form hydrogen bonds in aqueous solutions.
D) form ions in aqueous solutions.
E) be gaseous at room temperature.

21) The atomic number of each atom is given to the left of each of the elements below. Which of the atoms has the same valence as carbon ($^{12}_{6}C$)? 21) _____

A) $_{14}$Si silicon
B) $_{7}$N nitrogen
C) $_{9}$F fluorine
D) $_{10}$Ne neon
E) $_{12}$Mg magnesium

22) Two atoms appear to have the same mass number. These atoms 22) _____

A) must have the same number of protons + neutrons.
B) must have the same atomic number, the same number of protons + neutrons, the same number of electrons, and the same chemical properties.
C) must have the same atomic number.
D) must have the same chemical properties.
E) must have the same number of electrons.

23) Fluorine has an atomic number of 9 and a mass number of 19. How many electrons are needed to complete the valence shell of a fluorine atom? 23) _____

A) 7 B) 3 C) 0 D) 1 E) 9

24) What is the maximum number of electrons in a single 2 *p* orbital of an atom? 24) _____

A) 1 B) 2 C) 3 D) 4 E) 5

25) The organic molecules in living organisms have a measurably lower ratio of carbon-13/carbon-12, two stable isotopes of carbon that comprise approximately 1.1% and 98.9% of atmospheric carbon, respectively. What is a reasonable explanation for this phenomenon? 25) _____

A) Carbon dioxide molecules containing carbon-13 are heavier and sink into the ocean depths, making them less available to living organisms.
B) Photosynthesis preferentially uses carbon dioxide molecules with carbon-12, and the lower carbon-13/carbon-12 ratio propagates through the food chain.
C) Carbon dioxide molecules with carbon-13 stay in the upper atmosphere and are less available to terrestrial plants and algae.
D) Oxygen atoms preferentially react with carbon-13, thereby enriching the atmosphere with carbon dioxide molecules containing carbon-13 atoms.
E) Carbon-13 has a different valence electron configuration and is therefore less chemically reactive than carbon-12.

26) Phosphorus-32, a radioactive isotope of phosphorus-31 (atomic number 15), undergoes a form of radioactive decay whereby a neutron turns into a proton and emits radiation in the form of an electron. What is the product of such radioactive decay of phosphorus-32? 26) _____

A) a negatively charged phosphorus-32 ion
B) phosphorus-31
C) sulphur-32 (atomic number 16)
D) the conversion of the phosphorus-32 atom into pure energy
E) a positively charged phosphorus-31 ion

27) An atom with atomic number 12 would have what type of chemical behaviour in bonding with other elements? 27) _____

A) It would form ions with a +1 charge.
B) It would form ions with a +2 charge.
C) It would form ions with a -2 charge.
D) It would form two covalent bonds with other atoms.
E) It would form ions with a -1 charge.

28) If a salamander relied on hydrogen bonds to cling to surfaces, what type of surface would cause the most problems for this animal? 28) _____

A) a surface coated with a thin film of water
B) a surface made with carbon and hydrogen atoms covalently bonded together
C) a surface made with carbon, hydrogen, nitrogen, and oxygen atoms covalently bonded together
D) a surface made with silicon and oxygen atoms covalently bonded together
E) a surface made with carbon, hydrogen, and oxygen atoms covalently bonded together

29) A covalent chemical bond is one in which 29) _____

A) outer-shell electrons of two atoms are shared so as to satisfactorily fill the outer electron shells of both atoms.
B) an electron occupies a hybrid orbital located between the nuclei of two atoms.
C) protons and neutrons are shared by two atoms so as to satisfy the requirements of both atoms.
D) outer-shell electrons of one atom are transferred to fill the inner electron shell of another atom.
E) electrons are removed from one atom and transferred to another atom so that the two atoms become oppositely charged.

30) What is the best explanation for why molecules that an organism does not produce, but when exposed to react, can still impact the organisms function? 30) _____

A) The molecule is able to form covalent bonds on interacting with molecules in the organism.
B) The organism would have produced the molecule earlier in the organism's evolutionary history.
C) The molecule's shape is similar to a molecule the organism produces.
D) The molecule has a strong hydrogen (atomic number 1), which of the molecules below bonding capability.
E) Molecules will always have electrons in their outermost shell that can interact with atoms of other molecules.

31) What is the maximum number of covalent bonds an element with atomic number 8 can make with hydrogen? 31) _____

A) 6 B) 3 C) 1 D) 4 E) 2

32) Nitrogen (N) is much more electronegative than hydrogen (H). Which of the following statements is *correct* about the atoms in ammonia (NH_3)? 32) _____

A) There are covalent bonds between the hydrogen atoms and polar bonds between each hydrogen atom and the nitrogen atom.
B) Each hydrogen atom has a slight negative charge; the nitrogen atom has a strong positive charge.
C) The nitrogen atom has a slight positive charge; each hydrogen atom has a slight negative charge.
D) Each hydrogen atom has a partial positive charge; the nitrogen atom has a partial negative charge.
E) The nitrogen atom has a strong positive charge; each hydrogen atom has a strong positive charge.

33) When two atoms are equally electronegative, they will interact to form 33) _____

A) van der Waals interactions.
B) hydrogen bonds.
C) ionic bonds.
D) polar covalent bonds.
E) nonpolar covalent bonds.

34) What results from an unequal sharing of electrons between atoms? 34) _____

A) a polar covalent bond
B) a nonpolar covalent bond
C) an ionic bond
D) a hydrogen bond
E) a hydrophobic interaction

35) A covalent bond is likely to be polar when 35) _____

A) one of the atoms sharing electrons is much more electronegative than the other atom.

B) one of the atoms has absorbed more energy than the other atom.

C) oxygen is one of the two atoms sharing electrons.

D) the two atoms sharing electrons are equally electronegative.

E) the two atoms sharing electrons are different elements.

36) Which of the following molecules contains the most polar covalent bond? 36) _____

A) H_2O B) O_2 C) CO_2 D) H_2 E) CH_4

37) In comparing covalent bonds and ionic bonds, which of the following would you expect? 37) _____

A) An atom can form covalent bonds with multiple partner atoms, but only a single ionic bond with a single partner atom.

B) Covalent bonds and ionic bonds occupy opposite ends of a continuous spectrum, from nearly equal to completely unequal sharing of electrons.

C) Ionic interactions remain when covalent bonds are broken in water. Ionic bonds are much stronger than covalent bonds.

D) Both involve electrical attraction between the electrons of one atom and the nucleus of the other atom.

38) What is the difference between covalent bonds and ionic bonds? 38) _____

A) Covalent bonds involve the sharing of pairs of electrons between atoms; ionic bonds involve the sharing of single electrons between atoms.

B) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the sharing of protons between atoms.

C) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the electrical attraction between atoms.

D) Covalent bonds involve the transfer of electrons between atoms; ionic bonds involve the sharing of electrons between atoms.

E) Covalent bonds are formed between atoms to form molecules; ionic bonds are formed between atoms to form compounds.

39) In ammonium chloride salt (NH_4Cl) the anion is a single chloride ion, Cl. What is the cation of NH_4Cl? 39) _____

A) H_3, with a charge of +1

B) NH_4, with a charge of +4

C) NH_4, with a charge of +1

D) N, with a charge of +1

E) NH, with a charge of +1

40) The atomic number of chlorine is 17. The atomic number of magnesium is 12. What is the formula for magnesium chloride? 40) _____

A) MgCl B) $MgCl_3$ C) $MgCl_2$ D) Mg_2Cl E) Mg_2Cl_2

41) How many electron pairs are shared between carbon atoms in a molecule that has the formula C_2H_4? 41) _____

A) 0 B) 1 C) 2 D) 3 E) 4

42) Which bond or interaction would be difficult to disrupt when compounds are put into water? 42) _____

A) covalent bond
B) ionic bond
C) hydrogen bond
D) van der Waals interaction
E) either covalent bonds or ionic bonds

43) Which of the following explains most specifically the attraction of water molecules to one another? 43) _____

A) polar covalent bond
B) hydrogen bond
C) hydrophobic interaction
D) ionic bond
E) nonpolar covalent bond

44) Van der Waals interactions result when 44) _____

A) hybrid orbitals overlap.
B) two polar covalent bonds react.
C) electrons are not symmetrically distributed in a molecule.
D) a hydrogen atom loses an electron.
E) molecules held by ionic bonds react with water.

45) What bonding or interaction is most likely to occur among a broad array of molecules of various types (polar, nonpolar, hydrophilic, hydrophobic)? 45) _____

A) ionic bonding
B) polar covalent bonding
C) hydrogen bonding
D) covalent bonding
E) van der Waals interactions

46) Which of the following is *not* considered to be a weak molecular interaction? 46) _____

A) an ionic bond in the presence of water
B) a hydrogen bond
C) a covalent bond
D) a van der Waals interaction
E) both a hydrogen bond and a covalent bond

47) Which of the following would be regarded as compounds? 47) _____

A) H_2O, O_2, and CH_4

B) CH_4 and O_2, but not H_2O

C) H_2O and CH_4, but not O_2

D) H_2O and O_2

E) O_2 and CH_4

48) What is the maximum number of hydrogen atoms that can be covalently bonded in a molecule containing two carbon atoms? 48) _____

A) 4 B) 8 C) 3 D) 2 E) 6

49) Which of the following is *true* for this reaction? 49) _____

$3\ H_2 + N_2 \leftrightarrow 2\ NH_3$

A) Ammonia is being formed and decomposed.

B) Hydrogen and nitrogen are the reactants of the reverse reaction.

C) Hydrogen and nitrogen are being decomposed.

D) Hydrogen and nitrogen are the products of the forward reaction.

E) The reaction is nonreversible.

50) Which of the following *correctly* describes chemical equilibrium? 50) _____

A) Reactions stop only when all reactants have been converted to products.

B) Forward and reverse reactions have stopped so that the concentration of the reactants equals the concentration of the products.

C) Forward and reverse reactions continue with no effect on the concentrations of the reactants and products.

D) There are equal concentrations of reactants and products, and the reactions have stopped.

E) Concentrations of products are higher than the concentrations of the reactants.

51) Which of the following *correctly* describes any reaction that has reached chemical equilibrium? 51) _____

A) All of the reactants have been converted to the products of the reaction.

B) The rate of the forward reaction is equal to the rate of the reverse reaction.

C) Both the forward and the reverse reactions have stopped with no net effect on the concentration of the reactants and the products.

D) The concentration of the reactants equals the concentration of the products.

E) All of the products have been converted to the reactants of the reaction.

52) Which of these systems is least likely to be at chemical equilibrium? 52) _____

A) a test tube of organic molecules, kept in the freezer

B) a test tube of organic molecules dissolved in water, kept at room temperature

C) a test tube of dead cells in water, kept at room temperature

D) a test tube of living cells

E) a test tube of dry organic molecules, kept at room temperature

53) The combining of the metal, sodium, with the poisonous gas, chlorine, to produce an edible product, salt, is a good example of 53) _____

A) Van der Waals interactions.
B) covalent interactions.
C) emergent properties.
D) essential elements.
E) chemical equilibrium.

54) Plants that are capable of thriving in serpentine soil can do so as a result of 54) _____

A) serpentine soil poses no challenge to plants.
B) generating their own essential elements.
C) chemical neutralization of contaminants.
D) natural selection.
E) chance.

55) The three types of subatomic particles pertinent to the study of biology are 55) _____

A) electrons, photons, and neutrons.
B) quarks, photons, and gravitons.
C) electrons, protons, and neutrinos.
D) electrons, protons, and neutrons.
E) electrons, positrons, and neutrons.

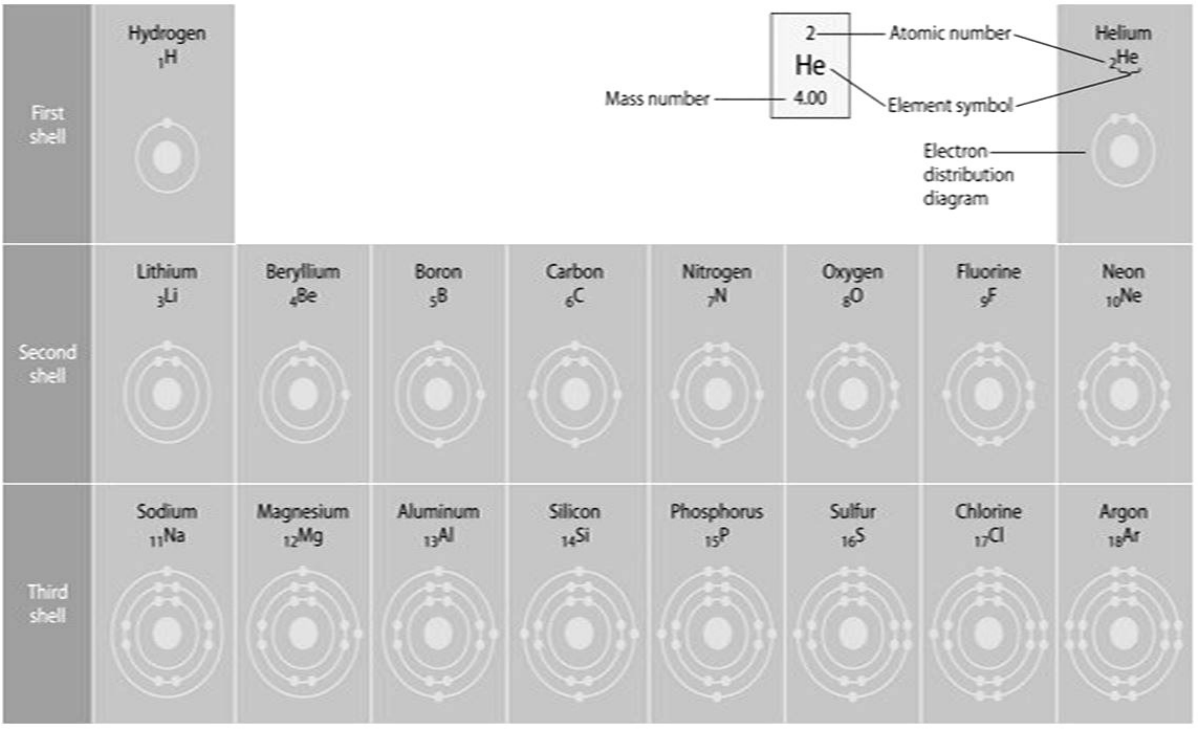
56) A dalton is a unit of 56) _____

A) weight.
B) distance.
C) mass.
D) bond strength.
E) energy.

57) Chemical bond/interaction strength appears in what order? 57) _____

A) Ionic > hydrogen > van der Waals > covalent.
B) Covalent > ionic > hydrogen > van der Waals.
C) Hydrogen > covalent > ionic > van der Waals.
D) Covalent > hydrogen > ionic > van der Waals.
E) Van der Waals > hydrogen > ionic > covalent.

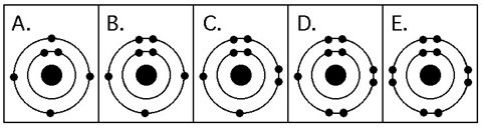
58) 58) _____



Refer to the figure above (first three rows of the periodic table). If life arose on a planet where carb were absent, which element might fill the role of carbon?

A) silicon
B) boron
C) phosphorus
D) aluminum
E) nitrogen

Use the following figure to answer the questions below.



59) Which drawing in the figure above depicts the electron configuration of an element with chemical properties most similar to Helium ($_2$He)? 59) _____

A) A B) B C) C D) D E) E

60) Which drawing in the figure above depicts the electron configuration of an atom that can form covalent bonds with two hydrogen atoms? 60) _____

A) A B) B C) C D) D E) E

61) Which drawing in the figure above depicts the electron configuration of an atom capable of forming three covalent bonds with other atoms? 61) _____

A) A B) B C) C D) D E) E

62) Which drawing in the figure above is of the electron configuration of a sodium $_{11}Na^{+}$ ion? 62) _____

A) A B) B C) C D) D E) E

63) Which drawing in the figure above depicts the most electronegative atom? 63) _____

A) A B) B C) C D) D E) E

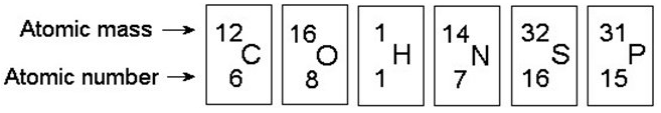
64) Which drawing in the figure above depicts an atom with a valence of 3? 64) _____

A) A B) B C) C D) D E) E

65) Which drawing in the figure above depicts an atom with a valence of 2? 65) _____

A) A B) B C) C D) D E) E

Use the following figure to answer the questions below.



66) In the figure above, how many electrons does nitrogen have in its valence shell? 66) _____

A) 2 B) 7 C) 5 D) 8 E) 14

67) In the figure above, how many unpaired electrons does phosphorus have in its valence shell? 67) _____

A) 2 B) 3 C) 5 D) 15 E) 7

68) How many neutrons are present in the nucleus of a phosphorus-32 (^{32}P) atom (see the figure above)? 68) _____

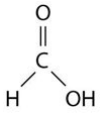
A) 15 B) 5 C) 16 D) 32 E) 17

69) How many electrons does an atom of sulphur have in its valence shell (see the figure above)? 69) _____

A) 6 B) 8 C) 4 D) 16 E) 32

70) Based on electron configuration, which of these elements in the figure above would exhibit a chemical behaviour most like that of oxygen? 70) _____

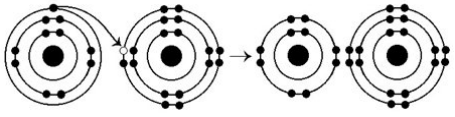
A) phosphorus
B) sulphur
C) hydrogen
D) carbon
E) nitrogen

71)  71) _____

The illustration above shows a representation of formic acid. Which statement *correctly* describes t formic acid molecule?

A) consists of largely nonpolar covalent bonds
B) will form hydrogen bonds with water molecules
C) has a tetrahedral shape and will form hydrogen bonds with water molecules
D) has a tetrahedral configuration of hybrid electron orbitals for the carbon atom
E) is held together by hydrogen bonds

Use the following figure to answer the questions below.



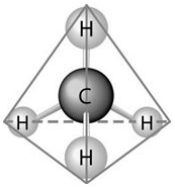
72) What results from the chemical reaction illustrated above? 72) _____

A) an anion with a net charge of +1
B) a cation with a net charge of +1
C) a cation with a net charge of +1 and an anion with a net charge of -1
D) a cation with a net charge of -1
E) an anion with a net charge of -1

73) What is the atomic number of the cation formed in the reaction illustrated above? 73) _____

A) 11 B) 10 C) 1 D) 16 E) 8

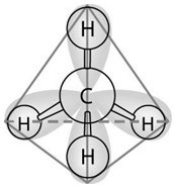
74) 74) _____



What causes the shape of the molecule shown above?

A) the configuration of the 2 *p* orbitals in the carbon atom
B) the packing of the carbon and hydrogen atoms in a crystal lattice
C) the configuration of the 1 *s* orbital in the carbon atom
D) hydrogen bonding configurations between the carbon and hydrogen atoms
E) the configuration of the hybrid orbitals of the electrons shared between the carbon and hydrogen atoms

75) 75) _____

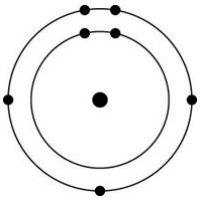


In the methane molecule shown in the figure above, bonds have formed that include both the *s* orb valence electrons of the hydrogen atoms and the *p* orbital valence electrons of the carbon. Which best describes the bonds in these electron orbitals?

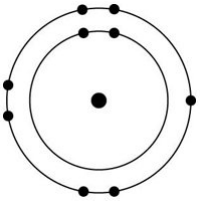
A) double orbitals
B) polar orbitals
C) tetrahedral orbitals
D) complex orbitals
E) hybrid orbitals

76) Which one of the atoms shown would be most likely to form a cation with a charge of +1? 76) _____

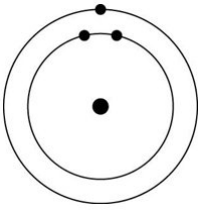
A)



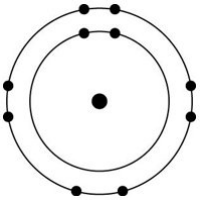
B)



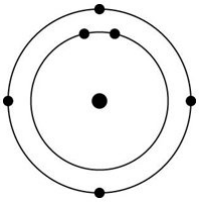
C)



D)

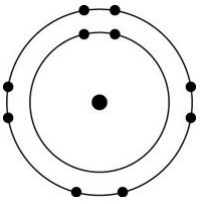


E)

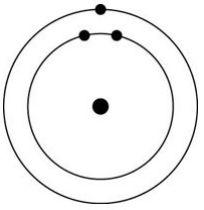


77) Which one of the atoms shown would be most likely to form an anion with a charge of -1? 77) _____

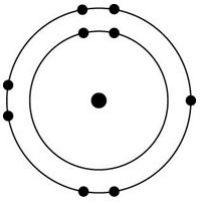
A)



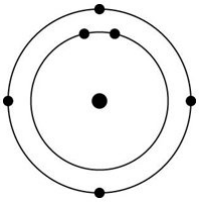
B)



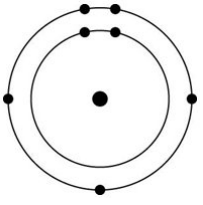
C)



D)

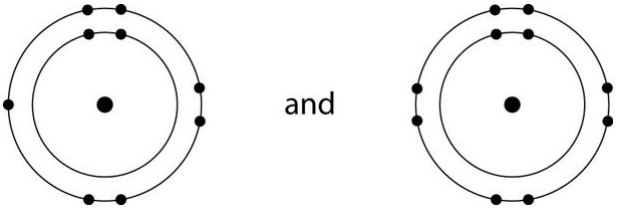


E)

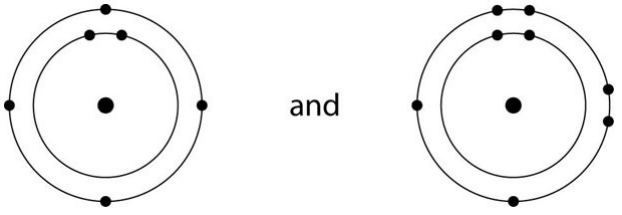


78) Which of the following pairs of atoms would be most likely to form a polar covalent bond? 78) _____

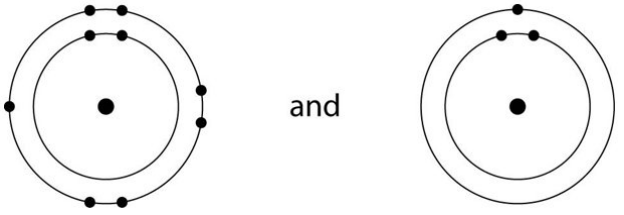
A)



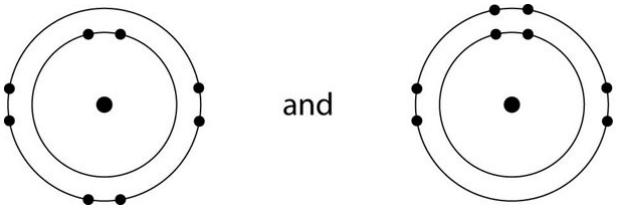
B)



C)



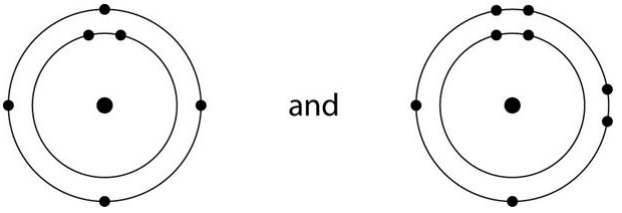
D)



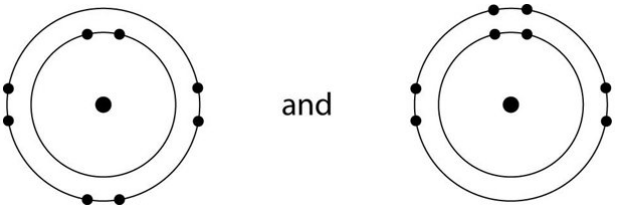
E)

79) Which of the following pairs of atoms would be most likely to form an ionic bond? 79) _____

A)

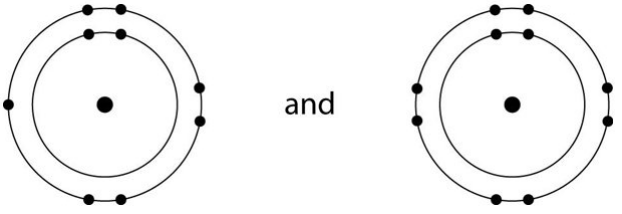


B)



C)

D)



E)

80) A group of molecular biologists is trying to synthesize a new artificial compound to mimic the effects of a known hormone that influences sexual behaviour. They have turned to you for advice. Which of the following compounds is most likely to mimic the effects of the hormone? 80) _____

A) a compound with the same three-dimensional shape as part of the hormone

B) a compound with the same number of hydrogen and nitrogen atoms as the hormone

C) a compound with the same molecular mass (measured in daltons) as the hormone

D) a compound with the same number of orbital electrons as the hormone

E) a compound with the same number of carbon atoms as the hormone

Use the following information to answer the questions below.

You are investigating how chemical reactions occur. You place two reactants together and measure the concentration of produ
regular intervals. After a time, the amount of product becomes stable.

81) Which of the following statements is *correct* about this solution? 81) _____

A) It has reached equilibrium, where the net formation of both product and reactants is neutral.
B) It has become saturated.
C) It has used up all the reactants, so no more product can be made.
D) It has reached equilibrium, where there is no more formation of the product.
E) It has used up all the product, so no more reaction is occurring.

82) If you add more product to the solution, what would you would expect to see? 82) _____

A) an increase in pH
B) the reactant concentration to remain the same
C) the reactant concentration to decrease
D) the reactant concentration to increase
E) a precipitation of the product

83) In the term *trace element,* what does the modifier *trace* means? 83) _____

A) The element can be used as a label to trace atoms through an organism's metabolism.
B) The element enhances health but is not essential for the organism's long-term survival.
C) The element is required in very small amounts.
D) The element passes rapidly through the organism.
E) The element is very rare on Earth.

84) Compared with ^{31}P, which of the following statements best describes radioactive isotope ^{32}P? 84) _____

A) a different charge
B) one more neutron
C) one more proton
D) a different atomic number
E) one more electron

85) What does the reactivity of an atom arises from? 85) _____

A) The average distance of the outermost electron shell from the nucleus.
B) The energy difference between the *s* and *p* orbitals.
C) The existence of unpaired electrons in the valence shell.
D) The sum of the potential energies of all the electron shells.
E) The potential energy of the valence shell.

86) Which statement is *true* of all atoms that are anions? 86) _____

A) The atom has more electrons than protons.
B) The atom has fewer protons than does a neutral atom of the same element.
C) The atom has more protons than electrons.
D) The net charge is negative 1.
E) The atom has more neutrons than protons.

87) Which of the following statements *correctly* describes any chemical reaction that has reached equilibrium? 87) _____

A) The rates of the forward and reverse reactions are equal.
B) The reaction is now irreversible.
C) No reactants remain.
D) Both forward and reverse reactions have halted.
E) The concentrations of products and reactants are equal.

88) We can represent atoms by listing the number of protons, neutrons, and electrons–for example, $2p^+$; $2n^0$; $2e^-$ for helium. Which of the following represents the ^{18}O isotope of oxygen? 88) _____

A) $8p^+$, $10n^0$, $8e^-$
B) $9p^+$, $9n^0$, $9e^-$
C) $6p^+$, $8n^0$, $6e^-$
D) $7p^+$, $2n^0$, $9e^-$
E) $10p^+$, $8n^0$, $9e^-$

89) The atomic number of sulphur is 16. Sulphur combines with hydrogen by covalent bonding to form a compound, hydrogen sulfide. Based on the number of valence electrons in a sulphur atom, predict the molecular formula of the compound. 89) _____

A) H_3S_2 B) HS C) H_4S D) HS_2 E) H_2S

90) What coefficients must be placed in the following blanks so that all atoms are accounted for in the products? 90) _____

$C_6H_{12}O_6 \rightarrow$ _____ C_2H_6O + _____ CO_2

A) 3; 1 B) 1; 3 C) 2; 2 D) 1; 2 E) 1; 1

91) Magnesium has an atomic number of 12. What is the most stable charge for a magnesium ion? 91) _____

A) a +1 charge B) a -1 charge C) a +2 charge D) a -2 charge

92) Which of the following *correctly* describes water's unique properties? 92) _____

A) Water molecules like to stick together due to hydrogen bonding.
B) Hydrogen bonds in liquid water form a crystalline structure.
C) Water is a non-polar molecule because oxygen and hydrogen have the same electronegativities.
D) Water has a low heat of vaporization resulting in the evaporative cooling effect we experience when we sweat.
E) Water has a low specific heat resulting in a significant amount of heat being released when hydrogen bonds form.

93) Which of the following accurately describes radioactive isotopes when used as diagnostic tracers? 93) _____

A) Radioactive isotopes used in chemical reactions in the cell are not hazardous to organisms.

B) Radioactive isotopes are used by cells differently than the analogous chemical. This allows for the identification of differences in cellular metabolism.

C) Radioactive isotopes are incorporated into biological molecules allowing for the tracking of cellular metabolism.

D) Positron-emission-tomography detects reduced chemical incorporation of the radioactive isotope.

E) Elevated isotope in a location in the body indicates the isotope is not being metabolized by the cell.

94) Which of the following *correctly* describes electrons? 94) _____

A) Electrons are neutral.

B) An electron can move from one shell to another only if the energy the electron gains is greater than the difference in energy between the energy levels of the two shells.

C) Electrons can move from the nucleus to higher energy levels when they absorb energy.

D) Protons, neutrons and electrons have equal mass.

E) Electrons are involved in the chemical reactions between atoms.

95) Why does radiometric dating allow researchers to determine the age of fossils? 95) _____

A) The half-life for all isotopes are all long, in the order of years.

B) Radioactive isotopes are incorporated into living organisms easier than the corresponding non-radioactive isotope.

C) All elements incorporated into living organisms have radioactive isotopes.

D) All radioactive isotopes have the same half-life.

E) The "parent" isotope decays into the "daughter" isotope at a fixed rate.

96) What are electrons in the outermost shell called? 96) _____

A) inert

B) high-energy

C) low-energy

D) unreactive

E) valence

97) Which statement *correctly* describes chemical reactions? 97) _____

A) The rate of chemical reactions is determined by reactant structure not reactant concentration.

B) All chemical reactions result in the making and breaking of bonds.

C) Chemical reactions proceed until all reactant becomes product.

D) Most chemical reactions are reversible.

E) There is less mass after molecules have undergone a chemical reaction.

98) What is the Lewis dot structure better at showing than the space filling model? 98) _____

A) The molecule's shape.
B) All electrons for a molecule.
C) The type of bond formed within the molecule.
D) The sharing of electrons within a molecule.
E) The molecule's size.

99) In a chemical reaction, what will the element ^{13}Al prefer? 99) _____

A) To lose five electrons and become positively charged.
B) To lose one electron and become positively charged.
C) To lose three electrons and become positively charged.
D) To gain three electrons and become positively charged.
E) To gain five electrons and become negatively charged.

100) What is the maximum number of covalent bonds that an oxygen atom with atomic number of 8 can make with hydrogen? 100) _____

A) 2 B) 8 C) 1 D) 4 E) 6

101) You are asked to indicate the type and number of atoms in a molecule. Which representation would work best? 101) _____

A) Lewis dot
B) ball-and-stick model
C) structural formula
D) molecular formula
E) space-filling model

102) Elements in the periodic table are organized from left to right order based on what characteristic? 102) _____

A) likelihood of decay
B) atomic mass
C) electric charge of the atom
D) the number of neutrons
E) atomic number

103) If an atom has a charge of +1, which of the following must be *true*? 103) _____

A) It has two more protons than neutrons.
B) It has the same number of protons as electrons.
C) It has one more proton than neutron.
D) It has one more proton than it does electrons.
E) It has one more electron than it does protons.

104) When the atoms involved in a covalent bond have the same electronegativity, what type of bond results? 104) ____

A) a polar covalent bond
B) a nonpolar covalent bond
C) a hydrogen bond
D) an ionic bond
E) van der Waals bond

Answer Key
Testname: UNTITLED1

1) C
2) E
3) A
4) E
5) E
6) B
7) D
8) B
9) C
10) B
11) E
12) E
13) C
14) E
15) D
16) D
17) C
18) A
19) C
20) B
21) A
22) A
23) D
24) B
25) B
26) C
27) B
28) B
29) A
30) C
31) E
32) D
33) E
34) A
35) A
36) A
37) B
38) C
39) C
40) C
41) C
42) A

43) B
44) C
45) E
46) C
47) C
48) E
49) A
50) C
51) B
52) D
53) C
54) D
55) D
56) C
57) B
58) A
59) E
60) C
61) B
62) E
63) D
64) B
65) C
66) C
67) B
68) E
69) A
70) B
71) B
72) C
73) A
74) E
75) E
76) C
77) C
78) B
79) E
80) A
81) A
82) D
83) C
84) B

85) C
86) A
87) A
88) A
89) E
90) C
91) C
92) A
93) C
94) E
95) E
96) E
97) B
98) D
99) C
100) A
101) D
102) E
103) D
104) B