Q1W1-Ch.Qs. Bank-Formation of Compounds

True/False

Indicate whether the statement is true or false.

- 1. An ionic crystal results from packing the constituent ions such that there is net zero force of attraction and repulsion.
- _____ 2. All noble gases have the same valence electron configuration.
- $_$ 3. An oxygen atom, having electron configuration $1s^2 2s^2 2p^4$, forms a single bond with another oxygen atom.

Modified True/False

Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

- 4. Carbon dioxide is present at a <u>higher</u> concentration in air that is exhaled than in air that is inhaled.
- 5. The most abundant element in the universe is <u>oxygen</u>.
- 6. The two raw materials for the process of photosynthesis are water and sugars.
- 7. The elements in column 18 of the periodic table are chemically <u>inactive</u>.
- 8. All of the noble gas elements except <u>neon</u> have eight electrons in their outermost energy level.
- 9. In covalent bonding, atoms can achieve a full octet of electrons by <u>sharing electrons</u>.
- 10. A typical potassium ion has a positive charge because it has lost an electron.
- 11. The following electron dot structure shows a bromine atom that has <u>lost</u> an electron to become an ion.
 - [:Br:]⁻
 - ..
 - 12. A crystal of the compound potassium fluoride consists of potassium and fluoride molecules.
- 13. The formula for methane, CH₄, indicates that each methane molecule contains <u>one</u> carbon atom and <u>four</u> hydrogen atoms.

Multiple Choice

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

- 14. Which of the following substances is an element?

 a. Baking soda
 b. Iron
 c. Salt
 b. Iron
 d. Sugar

 15. The electron configuration of Na is [Ne]3s¹ and that of Cl is [Ne]3s²3p⁵. What is the formula of the compound
- when these elements react? a. Na₂Cl c. NaCl

	b. NaCl ₂	d.	Na_2Cl_2
16.	Fluorine belongs to group 7A. How many cova	lent	bonds are formed between two fluorine atoms?
 	a. 1	с.	3
	b. 2	d.	4
17.	The properties of a compound are the pr	opei	ties of the elements that form it.
 1	a. similar to	с.	identical to
	b. different from	d.	derived from
18	A colorless odorless gas combines with a mag	netic	metallic element. What can you predict about the
 101	product?		
	a. It will also be magnetic.		
	b. A gas and a solid produce a liquid.		
	c. The compound will be shiny and odorless.		
	d. It is impossible to predict its specific prope	rties	
19.	Reactions between atoms involve only		
	a. valence electrons	c.	neutrons
	b. inner electrons	d.	protons
20.	Noble gases .		
	a. form no compounds		
	b. form compounds easily		
	c. form no compounds that occur naturally in	the	environment
	d. do not obey the octet rule		
 21.	Think of the terms octet, octopus, and octagon.	Inf	er the meaning of the prefix oct
	a. shape	c.	stable
	b. eight	d.	multi-
 22.	An atom of magnesium has two valence electro	ns.	It will most likely react with one atom of, which
	contains valence electrons.		
	a. carbon, 4	c.	oxygen, 6
	b. nitrogen, 5	d.	chlorine, 7
 23.	Oppositely charged ions attract each other, form	ning	a(n) bond.
	a. covalent	c.	ionic
	b. crystal	d.	molecular
 24.	The strong crystal structure of an ionic compou	nd i	s one reason ionic compounds have melting points.
	a. high	c.	moderate
	b. low	d.	variable
 25.	The formula for iron(III) oxide, Fe ₂ Cl ₃ , shows	that	one unit of the compound contains iron atoms.
	a. 2	c.	5
	b. 3	d.	6
 26.	Lithium has much less attraction for any valence	e el	ectrons than does fluorine. Atoms of these two elements
	would form bonds.		
	a. covalent	c.	crystal
	b. ionic	d.	molecular
 27.	Two atoms of bromine react with each other to	forr	$n a(n) \ bond.$
	a. covalent	c.	crystal
	b. ionic	d.	molecular
 28.	Electron sharing produces		
	a. crystals	c.	molecules
	b. ions	d.	liquids
 29.	A covalent compound is most likely formed from	m_	·

	a. two metals	c.	two metalloids
	b. two nonmetals	d.	a metal and a nonmetal
 30.	Nitrogen atoms each have five valence electron	s. H	ow many pairs of electrons must be shared in a molecule
	of N_2 ?		
	a. 1	c.	4
	b. 3	d.	6
 31.	Noble gases are sometimes used to protect value	able	documents because they are
	a. molecular	c.	unreactive
	b. totally inert	d.	unstable
 32.	When reacting with an atom of fluorine, an atom	n of	lithium will lose an electron and become a lithium
	a. compound	c.	ion
	b. crystal	d.	molecule
 33.	When an atom loses an electron, it becomes a _		_ ion.
	a. negative	c.	neutral
	b. positive	d.	polyatomic
 34.	A regular, repeating arrangement of atoms, ions	, or	molecules is
	a. amorphous	c.	a compound
	b. a crystal	d.	impossible to break down
 35.	A tug-of-war in which neither side is able to me	ove	the other side could be used to model a(n)
	a. covalent bond	c.	ionic bond
	b. crystal	d.	transfer of electrons

Completion

Complete each statement.

- 36. An ionic bond results due to the ______ attraction between two oppositely charged ions.
- 37. When a chemical bond is formed, the constituent atoms acquire the valence electron configuration of noble gases called ______.
- 38. A(n) ______ is an atom or group of atoms that carries an electric charge because it has gained or lost electrons.
- 39. A(n) ______ is a substance that conducts an electric current when dissolved in water or when melted.
- 40. An arrangement of valence electrons like that found in helium, argon, neon, and similar elements is known as a(n) ______.
- 41. The forces between the particles of a substance are called ______
- 42. The bond formed when two atoms share one or more pairs of electrons with each other is called a(n)
- 43. A(n) ______ is a regular, repeating arrangement of atoms, ions, or molecules of a solid.
- 44. A compound that consists of ions is called a(n) ______.
- 45. The bond formed when one atom transfers one or more electrons to a second atom is called a(n) ______.
- 46. A(n) ______ is the particle formed when two or more atoms are held together by means of covalent bonds.

- 47. A(n) ______ shows in a shorthand way the numbers and kinds of elements present in a compound.
- 48. A compound, the atoms of which are held together by means of bonds that involve electron sharing, is called a(n) _____.
- 49. According to the principle called the ______, an atom is stable when it has eight electrons in its outer energy level.
- 50. When comparing ionic and covalent compounds, most of the differences in physical properties result from the differences in _____.

Short Answer

- 51. Describe the composition of a molecule of the sugar sucrose, given that its formula is $C_{12}H_{22}O_{11}$.
- 52. Why is it incorrect to say that humans breathe in oxygen and breathe out carbon dioxide?
- 53. Why are the noble gases no longer called inert gases?
- 54. Give an example to show that an atom of an element has properties that are very different from those of an ion of the same element.
- 55. Compare and contrast the properties of the elements oxygen and carbon.
- 56. Not counting hydrogen, why is it that elements in column 1 of the periodic table do not tend to react with each other?
- 57. Nitrogen occurs in nature as a diatomic molecule—two atoms of nitrogen joined together. Draw the electron dot structure for that molecule. What kind of bond joins the atoms?
- 58. The nuclei of carbon and silicon have about the same tendency to attract electrons. What can you say about a chemical bond formed between these two elements?

Problem

Look at each of the electron dot structures shown below. In each case, decide: how many valence electrons are present; whether or not the particle is reactive; and if it is reactive, what it could do to become part of a stable compound and what kind of bond it would form in the process.

59. Rb·

60. ..

- :Ne:
- 61. .. [:Br:]⁻ ..

62. . •C∙

- .
- 63. Ba:

- 64.
- · ·N:
- .

Listed below are some imaginary data for a series of compounds. Based on what you have learned, predict whether each compound is probably ionic (I) or covalent (C). If the information given might apply to either kind of compound, put a question mark (?).

- 65. Has a melting point of 1650°C.
- 66. Is a gas at room temperature.
- 67. When melted, conducts an electric current well.
- 68. Is found in Earth's crust.
- 69. Is highly soluble in water.
- 70. Is a white solid at -100°C.
- 71. Has a boiling point of 13.2°C.
- 72. Is composed of a metal and a nonmetal.
- 73. When dissolved in water, does not conduct an electric current.
- 74. Is a hard, rough crystal.

Essay

- 75. Lithium is a reactive metal that reacts with oxygen to form an oxide.
 - a. How many valence electrons does lithium have?
 - b. How many electrons does lithium lose or gain to achieve a stable octet configuration?
 - c. What is the formula of lithium oxide?

Q1W1-Ch.Qs. Bank-Formation of Compounds Answer Section

TRUE/FALSE

1. AN	√S: T
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During the formation of a solid ionic compound, the positive and negative ions are packed into a regular repeating pattern that balances the forces of attraction and repulsion among the ions.

- PTS: 1 DIF: 1 REF: Page 135
- OBJ: 4.2.2 Demonstrate how and why atoms achieve chemical stability by bonding.
- TOP: Demonstrate how and why atoms achieve chemical stability by bonding.
- KEY: Ionic bond MSC: 2
- NOT: /T/ Correct! /F/ The net charge on an ionic compound is zero.
- 2. ANS: F

Helium has only two valence electrons, while all other noble gases have eight valence electrons.

- PTS: 1 DIF: 1 REF: Page 131 | Page 132
- OBJ: 4.2.1 Model two types of compound formation: ionic and covalent at the atomic level.
- TOP: Model two types of compound formation: ionic and covalent at the atomic level.
- KEY: Covalent bond MSC: 1
- NOT: /T/ Helium is an exception with only two valence electrons. /F/ Correct!
- 3. ANS: F

To fulfill its octet, each oxygen atom shares two electrons with another oxygen atom, forming a double covalent bond between them.

- PTS: 1 DIF: 2 REF: Page 140 | Page 142
- OBJ: 4.2.2 Demonstrate how and why atoms achieve chemical stability by bonding.
- TOP: Demonstrate how and why atoms achieve chemical stability by bonding.
- KEY: Double covalent bond MSC: 2
- NOT: /T/ Oxygen is two electrons short from fulfilling its octet. /F/ Correct!

MODIFIED TRUE/FALSE

4.	ANS:	Т			PTS:	1	DIF:	В
	OBJ:	4-2						
5.	ANS:	F, hydrogen						
	DTTC		DIE	D	ODI	4.0		
	PTS:	1	DIF:	В	OB1:	4-2		
6.	ANS:	F, carbon diox	kide					
	PTS:	1	DIF:	В	OBJ:	4-2		
7.	ANS:	Т			PTS:	1	DIF:	В
	OBJ:	4-4						
8.	ANS:	F, helium						
	PTS:	1	DIF:	В	OBJ:	4-4		

9.	ANS:	Т			PTS:	1	DIF:	В
	OBJ:	4-4						
10.	ANS:	Т			PTS:	1	DIF:	В
	OBJ:	4-3						
11.	ANS:	F, gained						
	PTS:	1	DIF:	В	OBJ:	4-3		
12.	ANS:	F, ions						
	PTS:	1	DIF:	В	OBJ:	4-4		
13.	ANS:	Т			PTS:	1	DIF:	В
	OBJ:	4-4						

MULTIPLE CHOICE

14. ANS: B

An element is a pure substance that cannot be separated into simpler substances by physical or chemical means.

	Feedback
Α	Baking soda is a compound.
В	Correct!
С	Salt is a compound.
D	Sugar is a compound.

PTS: 1 DIF: 1 REF: Page 120

OBJ: 4.1.1 Distinguish the properties of compounds from those of the elements of which they are composed. TOP: Distinguish the properties of compounds from those of the elements of which they are composed.

- KEY: Elements MSC: 2
- 15. ANS: C

To acquire a stable electron configuration, Na loses one electron, thereby forming Na⁺. Cl gains the electron, making Cl⁻. There is transfer of only one electron in the entire process.

	Feedback
Α	The metal loses only one electron from its outer orbital.
В	The halogen gains only one electron in the process.
С	Correct!
D	The formula should state the simplest ratio of ions.

PTS: 1 DIF: 2 REF: Page 133 | Page 138

OBJ: 4.2.2 Demonstrate how and why atoms achieve chemical stability by bonding.

TOP: Demonstrate how and why atoms achieve chemical stability by bonding.

- KEY: Ionic bond MSC: 2
- 16. ANS: A

Fluorine can acquire the configuration of a stable octet by sharing one electron with another fluorine atom, forming only one covalent bond.

	Feedback
Α	Correct!

В	There are seven valence electrons in fluorine. Each fluorine atom requires one more
	electron to fulfill the octet.
С	To form three covalent bonds with another fluorine atom, each atom needs three
	unpaired electrons.
D	To form four covalent bonds with another fluorine atom, each atom needs four unpaired
	electrons which it does not have.

	PTS:	1 DIF:	2	REF:	Page 140 Pa	ge 142	
	OBJ:	4.2.1 Model two type	es of compound	format	ion: ionic and	covalen	t at the atomic level.
	TOP:	Model two types of a	compound form	ation: io	onic and covale	nt at th	e atomic level.
	KEY:	Covalent bond		MSC:	2		
17.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-1
18.	ANS:	D PTS:	1	DIF:	В	OBJ:	4-1
19.	ANS:	A PTS:	1	DIF:	В	OBJ:	4-3
20.	ANS:	C PTS:	1	DIF:	В	OBJ:	4-5
21.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-5
22.	ANS:	C PTS:	1	DIF:	А	OBJ:	4-5
23.	ANS:	C PTS:	1	DIF:	В	OBJ:	4-4
24.	ANS:	A PTS:	1	DIF:	В	OBJ:	4-6
25.	ANS:	A PTS:	1	DIF:	В	OBJ:	4-5
26.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-4
27.	ANS:	A PTS:	1	DIF:	В	OBJ:	4-4
28.	ANS:	C PTS:	1	DIF:	В	OBJ:	4-4
29.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-5
30.	ANS:	B PTS:	1	DIF:	А	OBJ:	4-5
31.	ANS:	C PTS:	1	DIF:	В	OBJ:	4-5
32.	ANS:	C PTS:	1	DIF:	В	OBJ:	4-4
33.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-4
34.	ANS:	B PTS:	1	DIF:	В	OBJ:	4-3
35.	ANS:	A PTS:	1	DIF:	В	OBJ:	4-4

COMPLETION

36. ANS: electrostatic

	PTS:	1	DIF:	1	REF:	Page 134						
	OBJ:	4.2.2 Demonstr	ate ho	w and why ato	ms achi	eve chemical stability by bonding.						
	TOP:	Demonstrate ho	Demonstrate how and why atoms achieve chemical stability by bonding.									
	KEY:	Ionic bond	nic bond MSC: 1									
37.	ANS:	octet										
	PTS:	1	DIF:	1	REF:	Page 131 Page 132						
	OBJ:	4.2.1 Model tw	o types	s of compound	format	ion: ionic and covalent at the atomic level.						
	TOP:	Model two type	Model two types of compound formation: ionic and covalent at the atomic level.									
	KEY:	Octet	MSC:	1								
38.	ANS:	ion										
	PTS:	1	DIF:	В	OBJ:	4-1						

39. ANS: electrolyte

	PTS:	1	DIF:	В	OBJ:	4-1
40.	ANS:	noble gas cont	figuratio	on		
41.	PTS: ANS:	1 interparticle fo	DIF: orces	В	OBJ:	4-1
42.	PTS: ANS:	1 covalent bond	DIF:	В	OBJ:	4-1
43.	PTS: ANS:	1 crystal	DIF:	В	OBJ:	4-4
44.	PTS: ANS:	1 ionic compour	DIF: nd	В	OBJ:	4-3
45.	PTS: ANS:	1 ionic bond	DIF:	В	OBJ:	4-1
46.	PTS: ANS:	1 molecule	DIF:	В	OBJ:	4-4
47.	PTS: ANS:	1 formula	DIF:	В	OBJ:	4-4
48.	PTS: ANS:	1 covalent comp	DIF: oound	В	OBJ:	4-1
49.	PTS: ANS:	1 octet rule	DIF:	В	OBJ:	4-4
50.	PTS: ANS:	1 interparticle fo	DIF: orces	В	OBJ:	4-1
	PTS:	1	DIF:	В	OBJ:	4-6

SHORT ANSWER

- ANS: One sucrose molecule consists of 12 atoms of carbon, 22 atoms of hydrogen, and 11 atoms of oxygen.
 - PTS: 1 DIF: B OBJ: 4-1
- 52. ANS: Both inhaled and exhaled air contain both gases, as well as other gases.
 - PTS: 1 DIF: B OBJ: 4-2
- 53. ANS:

	A few compounds of the noble gases, which have full octets as free elements, have been produced in the laboratory.							
54.	PTS: ANS: Studen	1 t responses wil	DIF: l vary;	B they may, for e	OBJ: example	4-5 , compare sodium atoms to sodium ions, or chlorine atoms		
55.	to chlor PTS: ANS:	ride ions.	DIF:	В	OBJ:	4-1		
	Oxygen is a colorless gas at ordinary temperatures, is highly reactive, and supports combustion. Carbon is a solid and is not very reactive at ordinary temperatures. Both are nonmetals.							
56.	 ANS: All atoms of such elements react by losing their one valence electron and cannot lose it to another atom or same kind. 							
57.	PTS: ANS: The str	1 ucture is :N:::N	DIF:	B two nitrogen ato	OBJ:	4-5 e joined to each other by a triple bond.		
58.	PTS: ANS: The bo	1 nd will be cova	DIF: alent ra	A ther than ionic.	OBJ:	4-4		
	PTS:	1	DIF:	В	OBJ:	4-4		
PROBLEM	1							
59.	ANS: 1, react	tive, It would le	ose one	electron to and	other at	om to form an ionic bond.		
60.	PTS: ANS: 8, not r	1 reactive	DIF:	А	OBJ:	4-4		
61.	PTS: ANS: 8, not r	1 eactive	DIF:	А	OBJ:	4-4		
62.	PTS: ANS: 4, react	1 tive, It would p	DIF: probably	A y share electron	OBJ: s with	4-4 other atoms to form four covalent bonds.		

PTS: 1 DIF: A OBJ: 4-4

63. ANS:2, reactive, It would lose two electrons to form an ionic bond.

64.	PTS: ANS:	1	DIF:	А	OBJ:	4-4
	5, reac octet.	ctive, It would	usually	share three of it	ts five o	electrons to form three covalent bonds and achieve a stable
65.	PTS: ANS: I	1	DIF:	А	OBJ:	4-4
66.	PTS: ANS: C	1	DIF:	В	OBJ:	4-6
67.	PTS: ANS: I	1	DIF:	В	OBJ:	4-6
68.	PTS: ANS: ?	1	DIF:	В	OBJ:	4-6
69.	PTS: ANS: I	1	DIF:	В	OBJ:	4-6
70.	PTS: ANS: ?	1	DIF:	В	OBJ:	4-6
71.	PTS: ANS: C	1	DIF:	В	OBJ:	4-6
72.	PTS: ANS: I	1	DIF:	В	OBJ:	4-6
73.	PTS: ANS: C	1	DIF:	В	OBJ:	4-4
74.	PTS: ANS: I	1	DIF:	В	OBJ:	4-6
	PTS:	1	DIF:	В	OBJ:	4-6

ESSAY

75. ANS:

- a. Lithium has only 1 valence electron.
- b. Lithium loses its outermost lone electron from the 2s orbital to attain the stable configuration of helium.
- c. Li₂O

PTS: 1 DIF: 2 REF: Page 132 | Page 133

- OBJ: 4.2.2 Demonstrate how and why atoms achieve chemical stability by bonding.
- TOP: Demonstrate how and why atoms achieve chemical stability by bonding.

KEY: Ionic bond MSC: 2