Name: _____
Period: _____

Unit 6 Packet – Particles With Internal Structure

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Unit 6 Review (2 pages)	

DO NOT, under any circumstances, throw this away!
This packet MUST be saved for the final exam.

Learning Goal:

Students to use Thompson's model to explain how electron transfer causes particles to become charged. Students to be able to distinguish ionic compounds from molecular compounds as well as to name/write formulae for ionic and molecular compounds

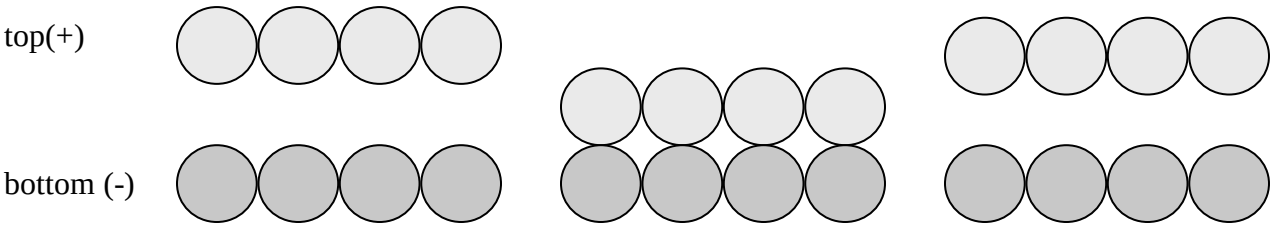
Scale

Score	Comment
Score 4	**Students show mastery of score 3 without any errors plus:** • **Use Thompson's model to predict how electrons would transfer in order to cause particles to become charged. Students to be able to compare and contrast ionic and molecular compounds as well as to name/write formulas for ionic and molecular compounds**
Score 3	**Without any major errors, students can independently:** • **Understand and use Thompson's model to explain how electron transfer causes particles to become charged. Students to be able to distinguish ionic compounds from molecular compounds as well as to name/write formulas for ionic and molecular compounds**
Score 2	**With one or two major errors, students can independently:** • **Understand that Thompson's model explains how electron transfer causes particles to become charged. Students to be able to distinguish ionic compounds from molecular compounds as well as to name/write formulas for ionic and molecular compounds**
Score 1	**With help from the teacher, students can:** • **Understand and use Thompson's model to explain how electron transfer causes particles to become charged. Students to be able to distinguish ionic compounds from molecular compounds as well as to name/write formulas for ionic and molecular compounds**
Score 0	**Even with the teachers help, students show no understanding or ability to:** • **Understand and use Thompson's model to explain how electrons transfer causes particles to become charged. Students to be able to distinguish ionic compounds from molecular compounds as well as to name/write formulae for ionic and molecular compounds**

Chemistry – Unit 6 Sticky Tape Post-Lab
Thomson Model and Sticky Tape

Let's see how we can use Thomson's model to explain the behavior of the sticky tape when we made our tape stacks.

A few atoms from the *top tape* and the *bottom tape* are represented in the diagram below. Add electrons to each atom to show what happens to the electrons when we make a tape stack out of neutral pieces of tape and then pull them apart.



Before adhesion In contact Separated

Describe the *macroscopic* changes in the tapes and then provide a *microscopic* explanation based on Thomson's model of the atom and your drawings.

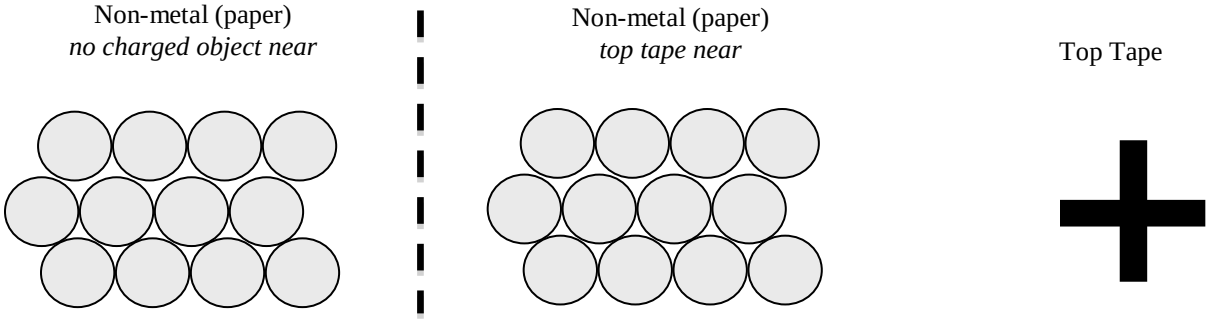
Behavior of Foil and Paper with Charged Tapes

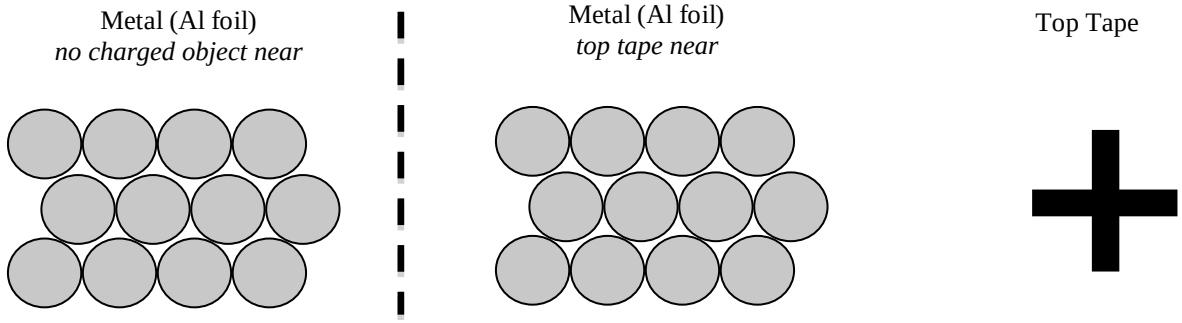
We observed that neither foil (metal atoms) nor paper (non-metal atoms) would attract each other. But foil and paper are **both** attracted to **both** the charged tapes (top and bottom).
How can we use the pudding model of atoms to explain the differences we observed?

Several atoms from the paper and foil are drawn on the next page. The ones on the left have no charged object near them. The ones on the right are next to a top tape (+ charge).

Add force vectors to the non-metal (paper) atoms and the top tape in the first row to show the attraction between the paper and the tape. Then do the same for the foil and the tape in the second row. Be sure the *size of the vectors* shows the relative strengths of the attractions.

Now draw the electrons in each atom "bowl" to show their arrangements when no charged object is near present and then when a charged object is brought near.





Explain why these arrangements of electrons would produce the observed attractions.

Chemistry – Unit 6 Notes
Thomson Model of the Atom

J. J. Thomson performed experiments with cathode rays in an attempt to understand electricity – which was still a mystery in the late 1800s. Review the website *A Look Inside the Atom*[1] to find the conclusions that Thomson and other physicists drew regarding the mysterious cathode rays.

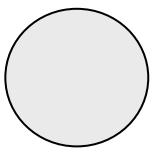
Thomson's 1897 Experiments - state the conclusions Thomson drew from each of his famous cathode ray experiments:

1. **First Experiment**: Thomson directed the beam at an electrometer and tried to separate the evidence of charge from the path of the beam. *What connection did Thomson find between charge and the cathode rays? Was the charge positive or negative?*

2. **Second Experiment**: Thomson tried passing the cathode ray through an electric field. *How did cathode ray beam behave when it passed through an electric field? What did he conclude after his second experiment?*

3. **Third Experiment**: Thomson did some careful measurements on how much the path of the cathode ray was bent in a magnetic field and how much energy they carried. From this work Thomson could describe the mass/charge ratio of the cathode ray particles. *What amazing result did Thomson find?*

Thomson's Atomic Model: Thomson presented three hypotheses from his experiments. Only two were accepted by physicists – in fact the third was shown to be wrong! From the first two came a model of the atom known as the *Plum Pudding* model. Complete the atom drawing below to illustrate Thomson's plum pudding model. Explain how this fits with his observations.



[1] http://www.aip.org/history/electron/jjhome.htm

Electrical Charge and Interactions of Matter Notes

Electrical Charge Definition:	• • •
Conservation of Electrical Charge	•
Nature of Electrical Charge	• Like charges _____ • Unlike charges _____ • Charged matter (+ or -) will attract neutral matter.
How Does a Charged Object Attract a Neutral Object? Polarization	• • •
Conductors Positively charged object and neutral conductor	• • • •

Negatively charged object and neutral conductor	•
Insulators Positively charged object and neutral insulator Negatively charged object and neutral insulator	• • • •
Questions:	1. When a charged object is brought into close proximity, will a conductor or an insulator show the greatest attraction? 2. Was the aluminum foil in the sticky tape lab a conductor or an insulator? 3. Was the paper in the sticky tape lab a conductor or an insulator? 4. Does a neutral object have any charges?

Molecular vs. Ionic Compounds

Molecular Compounds:	Ionic Compounds:
•	•
•	•
•	•
•	•
•	•

Summary Questions:

1. Why do molecular compounds have low melting and boiling points and ionic compounds have high melting and boiling points?

2. Why are aqueous ionic compounds conductors (electrolytes) and aqueous molecular compounds non-conductors (non-electrolytes)?

3. Why is salt (NaCl) a non-conductor in the solid state and a conductor when melted or mixed with water?

Binary Covalent Compound:

Naming and Formula Writing Notes

Keywords/Questions	Notes
Covalent compound definition	• •
Prefixes	1 = 6 = 2 = 7 = 3 = 8 = 4 = 9 = 5 = 10 =
Practice: Name to Formula	What is the formula for the following compounds? 1. Pentachlorine dioxide 2. Carbon monoxide 3. Tribromine hexasulfide
Practice: Formula to Name	What is the name of the following compounds? 1. P_4C_8 2. F_9I_6 3. SN_3
Naming Rules	1. 2. 3.

Name _____

Date _____ **Pd** ____

Chemistry – Unit 6 Worksheet 1

We have observed evidence that when M-NM compounds are dissolved, the metal particles tend to form positively charged ions (cations), while non-metal particles tend to form negatively charged ions (anions). However, when these same metal and non-metal particles are combined to form compounds they do not conduct electricity as solids. We will now examine the patterns that exist for the ratios in which these elements combine in order to determine the charges of the ions they form.

1. Write the formula and draw the particle diagram for each compound. *The ratio of ions in each compound is given.*

Atoms involved	1 calcium 1 oxygen	2 lithium 1 oxygen	2 aluminum 3 sulfur	1 beryllium 1 sulfur
formula				
particle diagram				

Atoms involved	2 boron 3 oxygen	1 magnesium 1 oxygen	2 sodium 1 sulfur
formula			
particle diagram			

Atoms involved	1 magnesium 2 chlorine	1 lithium 1 fluorine	1 beryllium 2 bromine	1 boron 3 chlorine
formula				
particle diagram				

Atoms involved	1 sodium 1 chlorine	1 calcium 2 bromine	1 aluminum 3 chlorine
formula			
particle diagram			

2. Write each formula from Question 1 in the boxes corresponding to its elements. For example, the compound formed from sodium and sulfur have been written in the box for sodium and in the box for sulfur. Now add the rest.

1A	2A	3A	4A	5A	6A	7A	8A
Hydrogen 1 **H**							Helium 2 **He**
Lithium 3 **Li**	Beryllium 4 **Be**	Boron 5 **B**	Carbon 6 **C**	Nitrogen 7 **N**	Oxygen 8 **O**	Fluorine 9 **F**	Neon 10 **Ne**
Sodium 11 **Na_2S**	Magnesium 12 **Mg**	Aluminum 13 **Al**	Silicon 14 **Si**	Phosphorus 15 **P**	Sulfur 16 **Na_2S**	Chlorine 17 **Cl**	Argon 18 **Ar**
Potassium 19 **K**	Calcium 20 **Ca**	Gallium 31 **Ga**	Germanium 32 **Ge**	Arsenic 33 **As**	Selenium 34 **Se**	Bromine 35 **Br**	Krypton 36 **Kr**

3. What patterns do you find in the formulas of the compounds formed in the table in #2?

   Based on these patterns, predict the formulas of the compounds formed by the ions below.

	Ratio of ions in compound		
Atoms involved	___ potassium ___ oxygen	___ calcium ___ sulfur	___ gallium ___ oxygen
formula			

4. How does a neutral atom become a positive ion? a negative ion?

5. Do the elements in group 1A behave more like top or bottom tape? How about the elements in group 7A? How so?

6. Make whatever generalizations you can about the charge of the ions formed by elements in columns 1A, 2A, 3A and 7A based on the ratio of atoms in each of the compounds they form.

7. Using the fact that compounds are also neutral, account for the fact that the ions combine in the ratios you have listed in the table in #2. Provide a couple of specific examples to support your explanation.

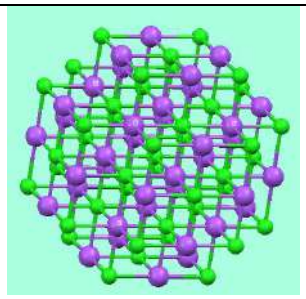
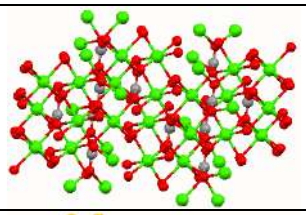
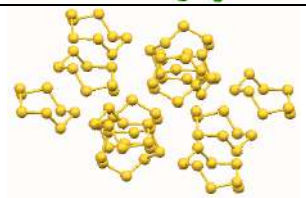
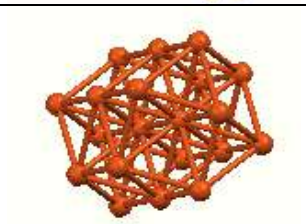
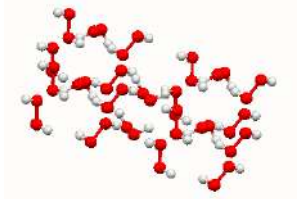
Name _____

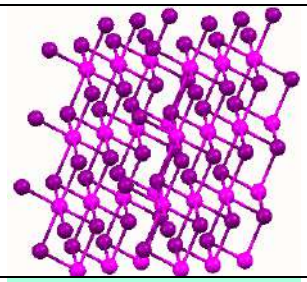
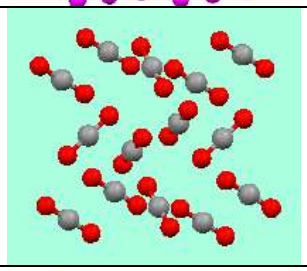
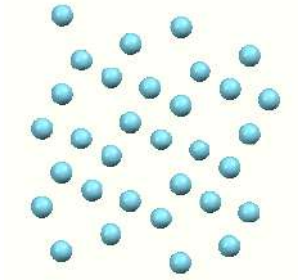
Date _____ **Pd** ____

Unit 6 – Worksheet 2

Why Structure is Important

In the table below, identify the type of solid (atomic, molecular, ionic) each substance forms. Then predict in which phase (solid, liquid or gas) each substance would exist on the Earth, on Mercury and on Pluto.

Substance	Crystal structure	Type	melting pt (°C) boiling pt (°C)	Phase at room temp on
NaCl			801 1413	Earth (25°C) Mercury (450°C) Pluto (-230°C)
$CaCO_3$			520 decomposes at 825	E M P
S_8			115 444	E M P
Cu			1084 2567	E M P
H_2O_2			-0.41 150	E M P

PbI_2			402 954	E M P
CO_2			-78 -57	E M P
Ar			-189 -186	E M P

Account for differences in the melting and boiling points of the three types of structures.

Predict which of these substances would conduct electricity when molten.

Would any of these conduct electricity as a solid?

Name _____

Date _____ Pd ____

Unit 6 – Worksheet 3
Ionic Compounds

Properties

Basic structural unit

1. Give the name of the following simple binary ionic compounds.

a. Na_2O

b. K_2S

c. $MgCl_2$

d. $CaBr_2$

e. BaI_2

f. Al_2S_3

g. CsBr

h. AgF

2. Give the name of the following simple binary ionic compounds.

a. Na_3N

b. K_2O

c. AgBr

d. MgI_2

e. SrO

3. Write the formula for the following binary ionic compounds.

a. lithium bromide

b. sodium iodide

c. silver sulfide

d. cesium oxide

d. beryllium iodide

f. barium hydride

g. aluminum fluoride

h. potassium oxide

4. Write the formula for these ionic substances.

a. silver oxide

b. aluminum sulfide

c. sodium nitride

d. barium chloride

e. strontium hydride

5. Write the name of these ionic substances using a Roman numeral to specify the charge of the cation.

a. $SnBr_2$

b. $SnBr_4$

c. CrO

d. Cr_2O_3

e. Hg_2I_2

f. HgI_2

6. Write the name of these ionic substances using a Roman numeral to specify the charge of the cation.

a. $PbCl_2$

b. Fe_2O_3

c. SnI_2

d. Hg_2O

e. HgS

f. CuI

7. Write the formulas of each ionic compound.

a. chromium (III) chloride

b. tin (IV) oxide

c. lead (II) oxide

d. copper (II) iodide

e. cobalt (II) oxide

f. cobalt (III) oxide

8. Write the formulas of each ionic compound.

a. chromium (III) sulfide

b. manganese (IV) oxide

c. gold (III) chloride

d. titanium (IV) chloride

e. iron (II) bromide

f. iron (II) oxide

Name _____

Date _____ Pd ____

Unit 6 – Worksheet 4
Molecular Compounds

Properties

Basic structural unit

1. Name each of the following binary compounds of non-metallic elements

a. CBr_4

b. N_2P_3

c. PCl_3

d. ICl

e. N_2O

f. SiF_4

2. Write the name for the following compounds of nonmetallic elements.

a. GeH_4

b. N_2Br_4

c. P_2S_5

d. SeO_2

e. NH_3

f. SiO_2

3. Write the formula for the following binary compounds of nonmetallic elements.

a. phosphorus triiodide

b. silicon tetrachloride

c. dinitrogen pentoxide

e. dinitrogen tetroxide

f. carbon monoxide

4. Write the formula for these compounds of nonmetallic elements.

a. carbon dioxide

b. sulfur hexafluoride

c. dinitrogen tetrachloride

d. carbon tetraiodide

e. phosphorus pentafluoride

f. diphosphorus pentoxide

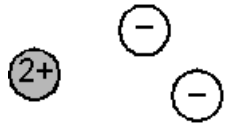
Name _____

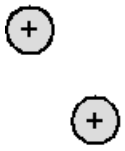
Date _____ Pd ____

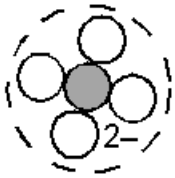
Unit 6 Worksheet 5

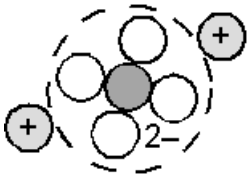
Representing Ions and Formula Units

	IONS			FORMULA UNIT	NAME
1.	Ca^{2+}	and	Br^{-}	_____	_____
2.	Fe^{2+}	and	Cl^{-}	_____	_____
3.	K^{+}	and	SO_4^{2-}	_____	_____
4.	Al^{3+}	and	NO_3^{-}	_____	_____
5.	Pb^{2+}	and	S^{2-}	_____	_____
6.	_____	and	_____	NH_4OH	_____
7.	_____	and	_____	$KHCO_3$	_____









8. _____ and _____ $Mg(NO_2)_2$ _____

9. _____ and _____ $ZnCO_3$ _____

10. _____ and _____ Na_3PO_4 _____

For 11 – 15 state the total number of atoms and the number of ions in the compound

11. _____ and _____ _____ silver chromate

____atoms ____ ions

12. _____ and _____ _____ lithium chlorate

____atoms ____ ions

13. _____ and _____ _____ copper (II) nitrate

____atoms ____ ions

14. _____ and _____ _____ iron (III) sulfide

____atoms ____ ions

15. _____ and _____ _____ calcium sulfate

____atoms ____ ions

Name _____

Date _____ Pd ____

Chemistry: Unit 6 - Worksheet 6

More Practice with Names and Formulas

	IONS			FORMULA	NAME
1.	Na^+	and	Br^-	_____	_____
2.	Cu^+	and	SO_4^{2-}	_____	_____
3.	Pb^{2+}	and	Cl^-	_____	_____
4.	K^+	and	S^{2-}	_____	_____
5.	Sn^{2+}	and	F^-	_____	_____
6.	_____	and	_____	BaI_2	_____
7.	_____	and	_____	$AlCl_3$	_____
8.	_____	and	_____	$Mg(NO_3)_2$	_____
9.	_____	and	_____	KOH	_____
10.	_____	and	_____	$(NH_4)_2SO_4$	_____
11.	_____	and	_____	_____	silver oxide
12.	_____	and	_____	_____	lithium bromide
13.	_____	and	_____	_____	copper (II) nitrate
14.	_____	and	_____	_____	magnesium chloride
15.	_____	and	_____	_____	calcium carbonate
16.	Mg^{2+}	and	NO_3^-	_____	_____
17.	Cu^{2+}	and	OH^-	_____	_____
18.	_____	and	_____	$NaHCO_3$	_____
19.	_____	and	_____	_____	iron (III) sulfide
20.	_____	and	_____	_____	potassium chromate

Part II

Write the names of the following compounds

1. $Cu(NO_3)_2$ _____
2. $BaCl_2$ _____
3. HgO _____
4. $Ni(OH)_2$ _____
5. Na_3PO_4 _____
6. $CaCO_3$ _____
7. CS_2 _____
8. $SnBr_4$ _____
9. $(NH_4)_2CrO_4$ _____
10. $Mg(NO_3)_2$ _____
11. Li_2O _____
12. FeS _____
13. NI_3 _____
14. H_2SO_4 _____
15. $K_2C_2O_4$ _____

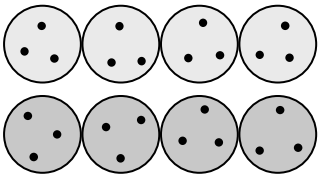
Part III

Write the formulas for the following compounds (not all are ionic)

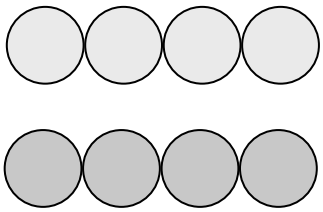
1. copper (II) sulfate _____
2. sodium chromate _____
3. iron (III) chloride _____
4. silver sulfide _____
5. aluminum oxide _____
6. zinc nitrate _____
7. potassium phosphate _____
8. strontium fluoride _____
9. ammonium carbonate _____
10. magnesium hydroxide _____
11. carbon tetrachloride _____
12. phosphorus tribromide _____
13. sulfur hexafluoride _____
14. sulfur dioxide _____
15. chromium (III) oxide _____
16. nitric acid _____
17. hydrochloric acid _____
18. lead(II) iodide _____
19. ammonium nitrite _____
20. potassium hydrogen carbonate _____

Unit 6 – Review

1. Recall your representations of the atoms in the Sticky Tape activity. Below is a pair of tapes before they have been pulled apart. Explain why they would **not** exert a force (either attractive or repulsive) on one another.

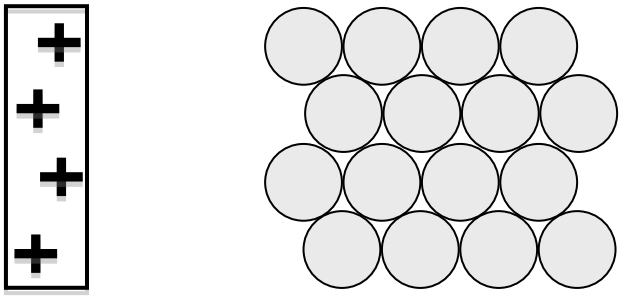


2. Below are groups of the inner cores of the atoms of the tapes after they have been pulled apart. Sketch in the mobile negative charges to show how the top tape becomes (+) and the bottom becomes (-).



3. What evidence allowed us to conclude that the top tape was (+)?

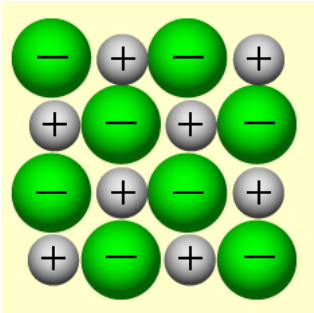
4. Below is a group of the inner cores of a piece of metal foil. Sketch in where you would expect to find the mobile negative charges if a top (+) tape were brought to the left of the foil. Explain your diagram.

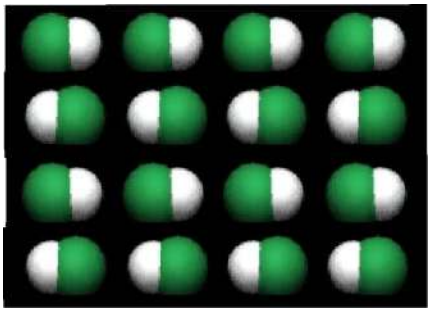


5. Describe how JJ Thomson concluded that the mobile charged particle in the atom had a (–) charge.

6. A solution of salt conducts electricity; a solution of sugar does not. Explain.

7. Below left is a 2-D array that represents an ionic lattice. At right is a 2-D array that represents a molecular solid. In what ways are they similar? In what ways are they different?





8. What evidence helped us to conclude that chloride ions have a (–) charge?

9. How do you decide how many ions of each type combine to form an ionic compound?

10. Why do ionic solids have higher melting and boiling points than do most molecular solids?

11. Why do we use the term "formula unit" rather than "molecule" when we refer to the simplest repeating unit of an ionic solid?

12. How many ions are formed when solid Na_2SO_4 dissolves? _____
    In what ways are the (+) and (–) ions different?

13. Apart from making life difficult for beginning chemistry students, why do chemists refer to CO_2 as carbon dioxide, yet use the name tin(IV) oxide to describe SnO_2?

14. Make sure that you know which combinations of elements give rise to ionic compounds and which form molecular compounds.

15. Make sure that you are familiar with the names, formulas and charge of the common ions you were assigned to learn so that you can readily name ionic compounds as well as write formulas for compounds whose names are given.