GCS Unit Plan Template

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Unit Overview

Unit Title **Unit 3**

Bonding Patterns, Geometric Shapes, Intermolecular Forces, Naming Cmpds

Unit Summary

Students will learn how compounds are formed as a result of the arrangement of their electrons around the atoms. They will also learn how compounds take on various geometric shapes as a result of the presence of electrons shared between elements in bond formation and those electrons that are not shared. Students will do this using group model building activities and computer simulations.

Subject Area

Chemistry

Grade Level

10-12

Approximate Time Needed

10x90 minutes

Unit Foundation

Targeted Content Standards and Benchmarks

Chem 1.2.1 Compare the relative strengths of ionic, covalent and metallic bonds.
Chem 1.2.2 Infer the type of bond formed between atoms/ions
Chem 1.2.3 Compare inter and intra particles forces
Chem 1.2.4 Interpret the name and formula of compounds using the IUPAC convention
Chem 1.2.5 Compare properties of ionic, covalent and metallic bonds

Student Objectives/Learning Outcomes

Chm.1.2.1

- Describe metallic bonds: "metal ions plus 'sea' of mobile electrons".
- Describe how ions are formed and which arrangements are stable (filled d-level, or half-filled d-level).
- Appropriately use the term cation as a positively charged ion and anion as negatively charged ion.
- Predict ionic charges for representative elements based on valence electrons.
- Apply the concept that sharing electrons form a covalent compound that is a stable (inert gas) arrangement.
- Draw Lewis (dot diagram) structures for simple compounds and diatomic elements indicating single, double or triple bonds.

Chm.1.2.2

- Determine that a bond is predominately ionic by the location of the atoms on the Periodic Table (metals combined with nonmetals) or when $\Delta EN > 1.7$.
- Determine that a bond is predominately covalent by the location of the atoms on the Periodic Table (nonmetals combined with nonmetals) or when $\Delta EN < 1.7$.

• Predict chemical formulas of compounds using Lewis structures.

Chm.1.2.3

• Explain why intermolecular forces are weaker than ionic, covalent or metallic bonds

• Explain why hydrogen bonds are stronger than dipole-dipole forces which are stronger than dispersion forces

• Apply the relationship between bond energy and length of single, double, and triple bonds (conceptual, no numbers).

• Describe intermolecular forces for molecular compounds.

§ H-bond as attraction between molecules when H is bonded to O, N, or F. Dipole-dipole attractions between polar molecules.

§ London dispersion forces (electrons of one molecule attracted to nucleus of another molecule) – i.e. liquefied inert gases.

§ Relative strengths (H>dipole>London/van der Waals).

Chm.1.2.4

• Write binary compounds of two nonmetals: use Greek prefixes (di-, tri-, tetra-, …)

• Write binary compounds of metal/nonmetal*

• Write ternary compounds (polyatomic ions)*

• Write, with charges, these polyatomic ions: nitrate, sulfate, carbonate, acetate, and ammonium.

• Know names and formulas for these common laboratory acids: HCl, HNO3, H2SO4, HC2H3O2, (CH3COOH)

**The Stock system is the correct IUPAC convention for inorganic nomenclature.*

Chm.1.2.5

• Explain how ionic bonding in compounds determines their characteristics: high MP, high BP, brittle, and high electrical conductivity either in molten state or in aqueous solution.

• Explain how covalent bonding in compounds determines their characteristics: low MP, low BP, poor electrical conductivity, polar nature, etc.

• Explain how metallic bonding determines the characteristics of metals: high MP, high BP, high conductivity, malleability, ductility, and luster.

• Apply Valence Shell Electron Pair Repulsion Theory (VSEPR) for these electron pair geometries and molecular geometries, and bond angles - Electron pair - Molecular (bond angle); Linear framework – linear; Trigonal planar framework– trigonal planar, bent; Tetrahedral framework– tetrahedral, trigonal pyramidal, bent; Bond angles (include distorting effect of lone pair electrons – no specific angles, conceptually only)

• Describe bond polarity. Polar/nonpolar molecules (relate to symmetry) ; relate polarity to solubility—"like dissolves like"

Describe macromolecules and network solids: water (ice), graphite/diamond, polymers (PVC, nylon), proteins (hair, DNA) intermolecular structure as a class of molecules with unique properties.

Cross-Curricular Connections

Art – construction of models
Math – geometric angles for molecular geometry

Curriculum-Framing Questions

Essential Question	How does the shape of molecules affect your daily life?
Unit Questions	What characteristics do you need to know to determine the type of bond that joins atoms/ions? What are the IUPAC rules that govern the naming of compounds?

Content Questions	What are characteristics of ionic, polar/nonpolar covalent and metallic bonds? What are the bond angles, number of attachments, number of shared and unshared electrons that are found in compounds that have the following shapes: linear, bent, trigonal planar, trigonal pyramidal, and tetrahedral? What role does electronegativity play in bond formation? What are the physical characteristics and relative bond strengths of the following intermolecular forces: Hydrogen bond, van der Waals force and London dispersion force?

Assessment Plan

Unit Details

Prerequisite Skills

Must know how to determine # of valence electrons in atoms and ions using electron configurations and the meaning of electronegativity.

Instructional Procedures

Review all material for Unit Test

Day 1

1- student definitions of ionic, covalent and metallic bonds

2- expand on their definitions to include information about electrons

3- identify the properties of the three bond types being sure to include a comparison of strength and physical and chemical characteristics of the compounds.

http://www.youtube.com/watch?v=QqjcCvzWwww

Homework – Worksheet on basic identification of bond types

Day 2 & 3

1- Review bond types

2- Distinguish between polar and nonpolar covalent cmpds using electronegativity differences.

3- Discuss molecular geometry.

Homework - *www.brightstorm.com/science/chemistry/chemical-**bonds**/**covalent-bonds**/*

Days 4 & 5

1- Review covalent, metallic and ionic bonds

2- Short Quiz

3- Discussion of the five basic geometric shapes (linear, bent, trigonal planar, trigonal pyramidal, tetrahedral) central atom, attachments, unshared pairs and bond angles. Use 8-1 PP 1-10 for class examples Students will draw a chart identifying the shape, central atom valence electrons, number of attachments, number of unshared pairs of electrons and finally the bond angle. Then they will use the chart as we answer four questions about the compounds.Is it a molecule? How many atoms in the cmpd? How many attachments? How many valence electrons around the central atom?

4- students will work in groups to construct the shape using model kits.

Days 6 & 7

1- Review molecular geometry http://www.youtube.com/watch?v=8JsK6rPpi70

2- short quiz on molecular geometry

Magic Trick using newspaper, baby powder and rubber cement

3- Discussion of bonds and intermolecular forces (this expands ionic and covalent and includes metallic bonds as well as the IMF's of van der Waals, London dispersion, and H bonds)

http://www.youtube.com/watch?v=_M9khs87xQ8

Day 8

1-Review IMF's

2-Students will begin writing names and formulas for ionic and covalent compounds using IUPAC approved format.

Day 9

Students will continue practicing formula writing and name procedures.

Group activity on naming and writing.

Review material for unit test

Day 10

Unit Test

Accommodations for Differentiated Instruction	
Special Needs Students	Preferred grouping, modified assignments, graphic organizers, enhanced technology (including translation software), acknowledgement of contributions of persons from various countries/nationalities
Gifted/Talented Students	Students will learn about the shapes of s and p clouds and the existence of additional geometric shape.

Materials and Resources Required For Unit

Technology – Hardware (Click boxes of all equipment needed)

X Interactive Technology	☐ Student Response System/Clickers	☐ Cell Phone
☐ Computer(s)/iPads, etc.	☐ Printer	☐ Video Camera
☐ Digital Camera	X Projection System	☐ Video Conferencing Equip.
X DVD Player	☐ Scanner	☐ Document Camera
X Internet	X Television	☐ Other

Technology – Software (Click boxes of all software needed.)

☐ Database/Spreadsheet	☐ Image Processing	☐ Web Page Development
☐ Desktop Publishing	X Internet Web Browser	☐ Word Processing
☐ E-mail	☐ Multimedia	☐ Other
X Web-Based Encyclopedia		

Printed Materials	Merrill and Prentice Hall texts and worksheets associated with each Teacher made worksheets *Current Science* Article on Smell and Taste
Supplies	Model Kits

Unit Plan Reflection

Describe any adaptations or "tweaks" to the resource or lesson plan that were needed:

This ran 2 days longer than expected due to a 2 hour fog delay. Under normal conditions this unit can be completed in ten days

What do you plan to do differently the next time you teach this unit?:
I will add this resource to next semester work.
https://www.khanacademy.org/science/chemistry/periodic-table-trends-bonding/v/ionic--covalent--and-metallic-bonds