Internet of Things (IoT) at UCF

UNIVERSITY OF CENTRAL FLORIDA

UCF RET Site: Collaborative Multidisciplinary Engineering Design Experiences for Teachers

2003350: Chemistry I Honors

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7/25/2018

READ THIS FIRST

- Write all lessons and activities in present tense.
- Be aware of copyright issues for images. Images used must be your own or in the public domain. It is easiest to use your own images. If using a public domain image you must document the source. Please note that images obtained from a google search are NOT public domain images.
- These lessons will be published. All work should be your own. Be sure to cite references where appropriate and only use images in the public domain/creative commons or that you develop. All lessons will be run through turnitin.com prior to publication.
- Remember to do your 3R reflection include an updated copy of your lesson plan, developed assessment tools, presentation materials, to the evaluator. See implementation plan instructions developed by the evaluator. Send within a week after completing the lesson to bonnie.swan@ucf.edu

RET Site: CoMET Lesson/Unit Plan

Lesson 1: Properties of Ionic and Covalent Compounds

Course(s): MYP Chemistry

Grade Level: 10

Suggested Length of Lesson: 5 days

Materials/Technology Available to Students for Inquiry

- Conductivity meters
- Watch glasses
- Mortar and pestles
- Magnifying glasses/microscopes
- Microscope slides
- Water
- Ethanol
- Stir rods
- Beakers
- Hot plates
- Test tubes
- Test tube clamps
- Test tube holders
- Bunsen burners
- Nichrome wire
- Scoopula/spatula
- Other materials added as needed/requested

Where this Fits

- Students should know basic physical properties of mater i.e. conductivity, melting/boiling points, solubility, etc.
- Students should know difference between an element and a compound as well as a metal and nonmetal.
- Beginning of Compounds Unit. This will be taught in conjunction with naming and writing ionic compounds.

Lesson Objective(s)/Learning Goal(s)

- Students will distinguish between ionic and covalent compounds based on their formulas.
- Students will differentiate between ionic and covalent compounds by performing different tests.

Standard(s)/Benchmark(s) Addressed

- SC.912.P.8.6 - Distinguish between forces holding compounds together and other attractive forces, including hydrogen and van der Waals.
- SC.912.P.8.7 -Interpret formula representations of molecules and compounds in terms of composition and structure.
- SC.8.N.1.1-use evidence from data to support scientific claims and conclusions.
- SC.8.N.1.2-design and conduct a study using repeated trials and replication

Standards for Mathematical Practice

- None

Instructional Strategies

- Inquiry
- Scaffolding
- Cooperative learning
- Peer Review

Evidence of Learning (Assessment Plan)

- Properties of compounds- pre and post quiz
- Research guiding questions
- Activity write up
- Venn Diagram

Description of Lesson Activity/Experiences

Day 1: Research

1. Propose research question to students: How can you tell an ionic compound from a covalent compound in lab? Use the internet AND textbook. Cite references. Record all information in lab notebook.
   Guiding Questions:
   a. List 4 qualitative test
   b. What equipment would you need for each test?
   c. Which test are conclusive?
2. Class discussion

Day 2: Write Procedure

1. Each group will write one procedure using the information from the class discussion and lab notebook. Turn into Canvas.
   a. Materials
   b. Bulleted procedure
   c. Picture of apparatus
   d. Data table
2. This procedure will be posted at the station on lab day. Under the procedure will be space for each group to make comments on the procedure i.e. easy to read, well written, confusing and add improvement.

Day 3-4: Lab Activity

1. Problem: Determine properties for the given ionic compound vs the given covalent compound.
2. Each group will visit each station: (10-15min)
   a. Read procedure
   b. Follow procedure as written; if changed write NEW procedure and WHY it was changed (lab notebook)
   c. Collect data in data table (lab notebook)
   d. Comment on procedure

Day 5: Write up and Class Discussion

1. Groups will receive template for write up. (Turn into canvas)
2. Discuss similarities and differences in properties for ionic vs covalent compounds; Venn diagram (exit slip).

Recommended Assessment(s) and Steps

- Properties of compounds- pre and post quiz (formal): Students will be assessed on the properties of ionic and covalent compound before and after this lesson. The same questions will be on both quizzes.
- Research guiding questions (informal): Questions will be provided to class to assist in productive research.
- Activity write up (Informal, Rubric): Each group must submit a write up of this activity using the rubric provided.
- Venn diagram (Informal, exit slip): This diagram will serve as the exit ticket to informally asses for learning before the post quiz.

List of Materials/Resources Used

- Periodic Table
- School issued textbook
- Internet access
- Zotero
- Guided Questions
- Discovery of Ionic vs Covalent Compounds Activity (Template)
- Pre/Post Quiz: Properties of Compounds

- Lab materials (see above)

RET Site: CoMET Lesson/Unit Plan

Lesson 2: Ionic Bonding

Course(s): MYP Chemistry

Grade Level: 10

Suggested Length of Lesson: 3 days

Materials/Technology Needed

- Nearpod
- Glowscript
- Edpuzzle
- Lattice Energy POGIL adapted

Where this Fits

- Students know how to name and write formulas for ionic compounds.
- Students know how to draw basic Lewis structures of ionic compounds.

Lesson Objective(s)/Learning Goal(s)

- Students will define lattice energy
- Students will list the 5 energies used to calculate the 5 energies to determine lattice energy
- Students will make particulate drawings to illustrate energy
- Students will determine the affect atomic/ionic size has on lattice energy
- Students will relate lattice energy to physical property of ionic compounds.

Standard(s)/Benchmark(s) Addressed

- SC.912.P.8.6 - Distinguish between forces holding compounds together and other attractive forces, including hydrogen and van der Waals.
- SC.912.P.8.7 -Interpret formula representations of molecules and compounds in terms of composition and structure.

Standards for Mathematical Practice

- MAFS.912.G-MG.1.1- Use geometric shapes, their measures, and their properties to describe objects

Instructional Strategies

- Effective Questioning
- Think-pair-share
- Multiple representations
- Collaborative Learning

Evidence of Learning (Assessment Plan)

- Pre/Post Quiz: Properties of Compounds
- Ionic Bonding Edpuzzle
- Ionic Bonding Introduction Edpuzzle
- Questions in Nearpod discussion
- POGIL: Lattice energy
- Crystal Lab report

Description of Lesson Activity/Experiences

Homework Prior to Day 1

Ionic Bonding Edpuzzle

Ionic Bonding Introduction Edpuzzle

Day 1-2: Steps and Energies

1. Nearpod: Ionic Bonding
2. POGIL: Lattice Energy

HW: Review Nearpod, Continue for mastery of Edpuzzles

Day 3: Structure (Lattice and Coordination number)

1. Nearpod: Lattice and Coordination number
2. Growing crystal was assigned in August in anticipation for US Crystal Growing competition (Alum and Magnesium Sulfate) Rubric
3. Students use information from this lesson to complete the multiple representations of matter portion for Magnesium Sulfate only:
    a. Formula
    b. Lewis structure
    c. Sphere (VPython) model including coordination number
    d. Photograph of crystal

Recommended Assessment(s) and Steps

- Pre/Post Quiz: Ionic Compounds
- Ionic Bonding Edpuzzle
- Ionic Bonding Introduction Edpuzzle
- Questions in Nearpod discussion
- POGIL: Lattice energy
- Crystal Lab report

List of Materials/Resources Used

- Nearpod
- Glowscript
- Edpuzzle
- Lattice Energy POGIL adapted

RET Site: CoMET Lesson/Unit Plan

Lesson 3: Covalent Compounds

Course(s): MYP Chemistry

Grade Level: 10

Suggested Length of Lesson: 5 days

Materials/Technology Needed	**Where this Fits**
▪ Nearpod ▪ Edpuzzle	▪ Students know how to name and write formulas for covalent compounds. ▪ Students know how to draw basic Lewis structures of covalent compounds.

<table>
<tr><td>Lesson Objective(s)/Learning Goal(s)
Students will define bond dissociation energy
Students will define chemical potential
Students will explain how the strength of a covalent bond is related to its bond dissociation energy
Students will be able to predict the shapes of molecules using VSPER theory
Students will relate lattice energy to physical property of ionic compounds.</td><td>Standard(s)/Benchmark(s) Addressed
SC.912.P.8.6 - Distinguish between forces holding compounds together and other attractive forces, including hydrogen and van der Waals.
SC.912.P.8.7 -Interpret formula representations of molecules and compounds in terms of composition and structure.</td></tr>
<tr><td>Standards for Mathematical Practice
MAFS.912.G-MG.1.1- Use geometric shapes, their measures, and their properties to describe objects</td><td rowspan="2">Instructional Strategies
Effective Questioning
Think-pair-share
Multiple representations
Collaborative Learning</td></tr>
<tr><td>Evidence of Learning (Assessment Plan)
Pre/Post Quiz: Covalent Compounds
VSPER Edpuzzle
POGIL: VSPER
Phet activity: Molecular Polarity
Pearson Chemistry Quick Lab: Strength of covalent bonds</td></tr>
<tr><td colspan="2">Description of Lesson Activity/Experiences
Homework Prior to Day 1
VSPER Edpuzzle
Day 1-2: Molecular Geometry
1. VSPER POGIL

Day 3-4 : Molecular Polarity
1. Phet activity: Molecular Polarity

Day 5 Bond dissociation energy
1. Pearson Chemistry Quick Lab: Strength of covalent bonds
a. Purpose: compare and contrast rubber bands to the dissociation energy of covalent bonds</td></tr>
<tr><td colspan="2">Recommended Assessment(s) and Steps
Pre/Post Quiz: Covalent Compounds
VSPER Edpuzzle
POGIL: VSPER
Phet activity: Molecular Polarity
Pearson Chemistry Quick Lab: Strength of covalent bonds</td></tr>
<tr><td colspan="2">List of Materials/Resources Used</td></tr>
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RET Site: CoMET Lesson Plan: Piezoelectric Effect

Course(s): MYP Chemistry
Grade Level: 10
Suggested Length of Lesson: 2 days

Materials/Technology Needed
- Substance to test: SiO_2, piezo buzzer
- LED light bulbs
- Foil
- Alligator clamps
- Voltmeter
- Oscilloscope

Where this Fits
- Student have completed covalent and ionic bonding

Lesson Objective(s)/Learning Goal(s)
- Students will be able to define the piezo effect
- Students will be able to compare and contrast the unit cell of a piezo substance and non-piezo substance
- Students will be able to describe properties of piezo materials
- Students will be able to describe at least one way to test for the piezoelectric effect of a substance.

Standard(s)/Benchmark(s) Addressed
- SC.912.P.8.6 - Distinguish between forces holding compounds together and other attractive forces, including hydrogen and van der Waals.
- SC.912.P.8.7 -Interpret formula representations of molecules and compounds in terms of composition and structure.
- SC.8.N.1.1-use evidence from data to support scientific claims and conclusions.
- SC.8.N.1.2-design and conduct a study using repeated trials and replication

Standards for Mathematical Practice
- MAFS.912.G-MG.1.1- Use geometric shapes, their measures, and their properties to describe objects

Instructional Strategies
- Inquiry
- Scaffolding
- Cooperative learning
- Close read

Evidence of Learning (Assessment Plan)
- Piezo substance pre and post quiz
- Questions in Edpuzzle
- Research guiding questions
-

Description of Lesson Activity/Experiences

HW Prior to lesson:

How to squeeze electricity out of crystals Edpuzzle

Day 1: Research

1. Propose research question to students: How can you tell if substance is Piezoelectric? Use the 2 resources; 1 provided and one new. Cite references. Record all information in lab notebook.
   Provided Reference: **Piezoelectricity** ("Piezoelectricity - How does it work?," n.d.)
   Guiding Questions:
   a. What does piezo- mean?
   b. What is the piezoelectric effect?
   c. How is the unit cell of a piezoelectric substance different from non-piezoelectric solids? Use visual.
   d. Suggest 1 qualitative test.
2. Class discussion

Day 2: Write Procedure and Demo

1. As a class, write a procedure using the information from the class discussion and lab notebook. Student centered; teacher facilitated. Record all information in lab notebook.

2. Carry out this procedure as a class demo. Record all observations in lab notebook. Materials available for Demo.
3. Individually make comments on the procedure i.e. easy to read, well written, confusing and add improvement.

Recommended Assessment(s) and Steps

- Piezo substance pre (informal) and post quiz (formal): Students will be assessed on the properties of ionic and covalent compound before and after this lesson. The same questions will be on both quizzes.
- Questions in Edpuzzle (informal): Informational video will be viewed by each student at their own pace. Check for understanding questions are embedded into the video. Students have multiple attempts and are required to score an 80% for mastery.
- Research guiding questions (informal): Questions will be provided to class to assist in productive research.
- Activity write up (Informal, Rubric): Each group must submit a write up of this activity using the rubric provided.

List of Materials/Resources Used

-

RET Site: CoMET Lesson: Classify the Substance

Course(s): MYP Chemistry

Grade Level: 10

Suggested Length of Lesson: 5 days

Materials/Technology Needed

- 4 unknown substance
- LED light bulbs
- Foil
- Alligator clamps
- Voltmeter
- Oscilloscope Conductivity meters
- Watch glasses
- Mortar and pestles
- Magnifying glasses/microscopes
- Microscope slides
- Water
- Ethanol
- Stir rods
- Beakers
- Hot plates
- Test tubes
- Test tube clamps
- Test tube holders
- Bunsen burners
- Nichrome wire
- Scoopula/spatula

Where this Fits

- This, along with a written test, is the culminating formative assessment of the unit.

<table>
<tr><td>

- Other materials added as needed/requested PRIOR to lab day

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Lesson Objective(s)/Learning Goal(s)

- Students will demonstrate understanding of different compounds and their properties by identifying unknown substances using the following labels: ionic compound, polar covalent compound, non-polar covalent compound, and/or piezoelectric substance.

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Standard(s)/Benchmark(s) Addressed

- SC.912.P.8.6 - Distinguish between forces holding compounds together and other attractive forces, including hydrogen and van der Waals.
- SC.912.P.8.7 -Interpret formula representations of molecules and compounds in terms of composition and structure.
- SC.8.N.1.1-use evidence from data to support scientific claims and conclusions.
- SC.8.N.1.2-design and conduct a study using repeated trials and replication
- HS-PS1-3.Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
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Standards for Mathematical Practice

- None

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Instructional Strategies

- Inquiry
- Cooperative learning

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Evidence of Learning (Assessment Plan)

- Group Lab Presentation (See rubric)

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Description of Lesson Activity/Experience

Objective: Classify each substance using 1 or more labels, ionic, covalent, polar, nonpolar, piezoelectric

Day 1: Write Procedure

1. Students will work in groups of 3 to write a procedure identifying 4 substances. They must use <u>at least</u> 3 qualitative test. Students must turn in list of materials for approval 1 week prior to lab dates. (Canvas)

Day 2-3: Lab Activity

3. Each group will visit stations according to approved procedure. Materials will be available according to the approved list. Each group will have 10-15 minutes per station. All procedures and results should be recorded in EACH member's lab notebook. See rubric.

Day 4: Write up

1. Groups will receive one class day for write up. (Turn into canvas)

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Recommended Assessment(s) and Steps

- Group Lab Presentation

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List of Materials/Resources Used

- Group Lab Presentation Rubric
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Important Vocabulary

Define unusual or probably unknown words. Write definitions in sentence format.

Term	Definition
Lattice energy	
Bond dissociation energy	
Piezoelectricity	
Transducer	

Troubleshooting Tips

Add anything helpful here.

Other Helpful Information

Add anything helpful here.

Attachments

Pre/Post Test: Compound Properties
Discovery of Ionic vs Covalent Compounds Activity Template
Pre/Post Test: Ionic Bonding
POGIL: Lattice energy Adapted from *Chemistry: a guided inquiry* (Moog & Farrell, 2017)
Pre/Post Quiz: Covalent Compounds
POGIL: VSPER Adapted from *Chemistry: a guided inquiry* (Moog & Farrell, 2017)
Phet activity: Molecular Polarity (Timothy Herzog & Emily Moore, 2015)
Pearson Chemistry Quick Lab: Strength of covalent bonds (Wilbraham & Staley, 2012)
Piezo substance pre and post quiz
Culminating Lab Rubric

References

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Acknowledgements

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