

Electronegativity POGIL

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Why:

Electronegativity is the driving force to predict the reactive nature of an atom, ion, or compound. It also is used to predict the shape of molecules.

Objectives:

- Students will explore the concepts of bond energy and its relationship to stability of an atom
- Students will explore Pauling scale of Electronegativity

Success Criteria:

- Students will use electronegativity to predict the nature of a bond within a molecule as ionic, polar, or covalent

Prerequisites:

- Students will need to know the charge of an electron and a proton
- Students will need to understand Coulomb's Law

Resources:

Chemistry: The Central Science Text; Brown, Bursten, and Lemay; 11th edition, Prentice Hall, 2007

Vocabulary:

Electronegativity is the tendency of an atom in a molecule to attract shared electrons to itself.

Bond energy is the amount of energy required to break a bond between two atoms in a molecule.

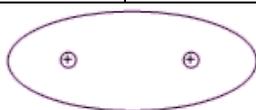
Team Roles:

Write the name of each person who is filling the following roles. If you are working in a group of three, one person will need to fill more than one role.

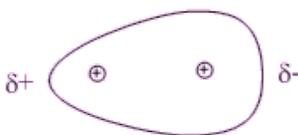
- _____ The *manager* actively participates, keeps the team focused on the task, distributes work and responsibilities, resolves disputes, and assures that all members participate and understand.
- _____ The *spokesperson* actively participates and presents reports and discussion to the class. This is the only person who will communicate with the Facilitator.
- _____ The *recorder* actively participates, keeps a record of the assignment and what the team has done, and prepares a separate copy of the POGIL in consultation with the others to be handed in.
- _____ The *strategy analyst* (or *reflector*) actively participates, identifies strategies and methods for problem solving, identifies what the team is doing well and what needs improvement in consultation with the others, and prepares a report (*Last Page*) in consultation with the others.

Model 1: A Table of Pauling Electronegativity Values

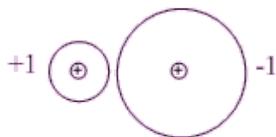
H 2.2						
Li 1.0	Be 1.6	B 2.0	C 2.6	N 3.0	O 3.4	F 4.0
Na 0.9	Mg 1.3	Al 1.6	Si 1.9	P 2.2	S 2.6	Cl 3.2
K 0.8	Ca 1.0	Ga 1.8	Ge 2.0	As 2.2	Se 2.6	Br 3.0
Rb 0.8	Sr 1.0	In 1.8	Sn 2.0	Sb 2.1	Te 2.1	I 2.7



A nonpolar covalent bond formed between identical atoms, or atoms of near-identical electronegativity values.



A polar covalent bond formed when there is a small electronegativity difference between the atoms.



An ionic bond formed when there is a large electronegativity difference between the atoms. There is no sharing of electrons in an ionic bond.

The dividing line between ionic and covalent bonding is not definite. However, as a general guideline, if the electronegativity is smaller than about 1.5, the bond can reasonably be taken to be covalent. If the difference is greater than 2, the bond is essentially ionic. Differences between 1.5 and 2 will correspond to bonds which have significant ionic and covalent character.

Critical Analysis Questions:

- Provide an example of a molecule that has polar covalent bonds that are more polar than the bonds in NH_3 .
- For each of the following, which has the most polar bonds?
 - CF_4 , NF_3 , OF_2
 - OF_2 , SF_2 , SeF_2
 - B_2O_3 , Al_2O_3 , CO_2
 - P_2O_3 , NO_2 , SO_2
- When an ionic bond is formed, what type of atom is likely to lose one or more electrons? What type of atom is likely to gain one or more electrons? Why?

Exercises

1. Classify the bond in each of the following as nonpolar, polar, or ionic:

- a) O_2
- b) NaF
- c) KCl
- d) NO
- e) ICl
- f) CO_2

2. Classify each of the following bonds as nonpolar, polar, or ionic

- a) C-H in CH_4
- b) Si-Cl in $SiCl_4$
- c) Al-O in Al_2O_3
- d) H-S in H_2S

Strategy Analyst's Report: Electronegativity POGIL

How Strong Is Your Team?

For each item, score your team's performance as:

1 = not very good

2 = needs significant improvement

3 = needs some improvement

4 = adequate

5 = stellar

Item	Score	Justification	Plan
Everyone came prepared.			
Everyone participated fully.			
We encouraged and helped each other.			
Everyone asked questions when they didn't understand.			
Everyone gave clear explanations to each other.			
Everyone contributed ideas.			
We listened to each other.			
Each person contributed to our success; no one dominated.			
Everyone understood the material.			
We completed the assigned work.			
Total			

Write a justification for your score and provide a plan for improving your team's performance.

What was the most useful thing you learned during this session?

What questions remain uppermost in your mind as we end this session?