

- Purpose:** (1) To observe the solubility of liquids and solids.
(2) To make a connection between a substance's polarity and its solubility.

Part I: Determining polarities based on molecular structures.

- a) Fill in the following chart by drawing the 3D diagrams and labeling each as being nonpolar covalent (NPC), polar covalent (PC) or ionic (I) . Look at the molecular models of these liquids to help you draw the 3D diagrams and to determine their polarities.

	Water	Ethylene Glycol	Cyclohexane	Hexane	Ethanol
Lewis Dot					
3D Diagram with partial charges					
Polarity (NPC, PC, Ionic)					

- b) Rank these liquids as best you can according to their polarities by placing each of them appropriately on this polarity “number line.”
- You will not be able to differentiate between nonpolar covalent molecules-- just write all nonpolars near the same spot on the line.
 - In order to differentiate between slightly polar covalent, polar covalent and very polar covalent, look at the **percent of the molecule that is partially charged.** (*Do all of the atoms have partial charges? some of them?*) Do NOT base your decision on how large the electronegativity differences are.

nonpolar
covalent

slightly polar
covalent

polar
covalent

polar
covalent

ionic

Part II: Data Collection-- Solubility of Five Liquids, NaCl and I₂ (as a demo)

- a) Obtain a test tube rack and five dry, clean test-tubes. Obtain the 5 dropper bottles of the 5 liquids.
- b) **LIQUIDS:** Choose two liquids to mix. Put in 2-3 dropper-fulls of each liquid into the same test tube. Put on a stopper and shake. Let the liquids settle and observe whether they are soluble or insoluble. *(If there is a line about halfway down, there are two layers and the liquids are INSOLUBLE. Make all combinations of liquids and record results in the data chart below.*
- You MUST use a DRY test tube each time you are using ETHANOL!!
 - Cyclohexane and hexane must be disposed of in the WASTE bottle. Other liquids may go down sink.
- c) **NaCl test:** Put a tiny pinch of NaCl into five test tubes *(Try to use about the same amount in each test tube.)* In each of the test tubes, you will add a different liquid. Again use 2-3 dropper-fulls of the liquids. Put on a stopper and shake. Look carefully to see if NaCl is soluble, slightly soluble or insoluble in each liquid. (Did ALL, SOME or NONE of the NaCl dissolve?)

	water	ethylene glycol	cyclohexane(waste)	Hexane (waste)	Ethanol (dry tt)
water	XXXXX				
ethylene glycol	XXXXX	XXXXX			
cyclohexane(waste)	XXXXX	XXXXX	XXXXX		
hexane (waste)	XXXXX	XXXXX	XXXXX	XXXXX	
ethanol (dry tt)	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
NaCl (s)					
I ₂ (s) -- as a demo!					

Part III: Making a Hypothesis using just your data concerning the LIQUIDS

Compare the polarities of the five liquids (Part I) with the solubility results of the five liquids (Part II). Try to look for patterns. Then, make a HYPOTHESIS or generalization which is able to PREDICT the solubility of the liquids from their polarities. Write your hypothesis by completing the statement below. This should be a GENERAL statement which can be used in all situations. No EXCEPTIONS are allowed.

Hypothesis: Two substances will be soluble if _____

Part IV: TESTING YOUR HYPOTHESIS (Solubility of NaCl and I₂)

- 1) What is the polarity of NaCl? _____ *On the front page, write in NaCl appropriately on the polarity number line.*
- 2) Look at your solubility data above. Is NaCl more soluble in water or in ethylene glycol? _____
State the polarity of each substance (NaCl, water& ethylene glycol) and use your hypothesis to explain why.
- 3) What is the polarity of I₂? _____ *On the front page, write in I₂ appropriately on the polarity number line.*
- 4) Make a prediction: Which liquid should I₂ be most soluble in? _____
- 5) I will demo the solubility of I₂. Record results in the chart above. Does hypothesis fit data results? _____