

Geometric Isomers and Intermolecular Forces

Date: _____ Names: _____ Lab Section _____

OBJECT: To investigate intermolecular forces and reactivity in various compounds.

PROCEDURE: As in Chem 1110 manual pages _____.

Part A. Miscibility of Liquids and Intermolecular Forces

In small test tubes, mix the following solvent pairs as demonstrated and record whether the solvent pair is miscible (M) or immiscible (I).

Solvent Pair	Water/ Methanol	Water/ Isopropanol	Water/ Cyclohexanol	Water/ Acetone	Water/ Cyclohexanone
Observed Miscibility					

Solvent Pair	Hexane/ Water	Hexane/ Methanol	Hexane/ Isopropanol	Hexane/ Cyclohexanol	Hexane/ Cyclohexanone
Observed Miscibility					

Based on the above observations, complete the following table:

Solvent	Structural Formula	H-Bonding ? Y/N	Dipole-dipole? Y/N	London Forces? Y/N	Strongest inter- molecular force
Water					
Methanol					
Isopropanol					
Cyclo- hexanol					
Acetone					
Cyclo- hexanone					
Hexane					
Carbon Tetra- chloride					
Toluene					

Predict the miscibility of the following solvent pairs:

Solvent Pair	Carbon Tetrachloride/ Hexane	Carbon Tetrachloride/ Water	Toluene/ Water
Predicted Miscibility			

Questions:

1) Based on your observations from part A, briefly suggest what conditions must be met in order for two liquids to be miscible.

2) Given a mixture of methanol and hexane (they are immiscible), suggest a liquid used in today's lab that when added to this mixture, makes all three miscible. Try it out.

Part C. Physical Properties of Maleic and Fumaric Acid Step 1

Test	Observations
Maleic Acid and Water	
Fumaric Acid and Water	

Questions:

1) Explain the observed differences in solubility between fumaric and maleic acid in terms of molecular polarity and H-bonding.

2) Which isomer would be expected to have the higher melting point based on:
a) molecular polarity? Explain.

b) *intermolecular* and *intramolecular* H-bonding? Explain.

c) Which factor is predominant based on the observed melting point?

Part C. Physical Properties of Maleic and Fumaric Acid Steps 2 & 3

Test	Observations	
	Reaction with Mg	Reaction with NaHCO ₃
1.0M HCl		
0.1M HCl		
0.01M HCl		
Saturated Fumaric acid		
Saturated Maleic acid		
Unsaturated Maleic acid		

Questions:

1) Explain the observed differences in reactivity with Mg metal and solid NaHCO₃ between:
a) 1.0M HCl, 0.1M HCl, and 0.01M HCl.

b) Saturated fumaric acid solution and unsaturated maleic acid solution.

b) Are the observations in a) and b) related? Explain.

CONCLUSION: