



IMFs: Polarity on Wax Paper *Preparer's Version*

Introduction

Intermolecular forces (IMFs) are the forces that mediate interactions between molecules, dictating the physical properties and behaviors of substances. These forces include dispersion forces, dipole-dipole interactions, and hydrogen bonding. The surface tension of a liquid is intimately connected to its cohesive (attraction between similar molecules) and adhesive (attraction between dissimilar molecules) properties, which are determined by the strength of its IMFs. Liquids with strong cohesive forces, such as water, exhibit high surface tension because the molecules at the surface are pulled inward by hydrogen bonds. In contrast, liquids with weaker IMFs, like hexane with its dispersion forces, show lower surface tension. Adhesive forces, on the other hand, determine how a liquid interacts with different surfaces.

Safety Hazards

- Personal Protective Equipment
 - Safety glasses/goggles
 - Nitrile gloves
- Physical Hazards
 - Ethanol is a highly flammable liquid and vapor.
 - Hexanes is a highly flammable liquid and vapor.
- Chemical Hazards
 - Ethanol causes serious eye irritation.
 - Hexanes may be fatal if swallowed or if it enters airways; cause skin irritation and may cause drowsiness or dizziness; suspected of damaging fertility or the unborn child and may cause damage to organs (Nervous system) through prolonged or repeated exposure if inhaled. Toxic to aquatic life with long lasting effects.
 - Iodine causes skin irritation and serious eye irritation; may cause respiratory irritation; causes damage to organs through prolonged or repeated exposure; Harmful if swallowed, in contact with skin or if inhaled.

Materials

- 20 mL water
- 20 mL ethanol, 200 proof
- 20 mL hexanes
- Iodine, crystalline (1 crystal)
- 3x glass dropper bottles
- Wax paper
- Red and blue food coloring

Safety Data Sheet(s)

- [Ethanol, 200 proof](#)
- [Hexanes](#)
- [Iodine, crystalline](#)



Procedure

1. Measure 20 mL deionized water and add 1 – 2 drops of blue food coloring. Mix thoroughly and pour into a clean glass dropper bottle. Make sure the bottle is clearly labeled.
2. Measure 20 mL ethanol and add 1 – 2 drops of red food coloring. Mix thoroughly and pour into a clean glass dropper bottle. Make sure the bottle is clearly labeled.
3. Measure 20 mL hexanes and add 1 iodine crystal. Allow the crystal to dissolve and dye the liquid purple and then pour into a clean glass dropper bottle. Make sure the bottle is clearly labeled.

Tips & Tricks

- If presenting to a larger group, project the wax paper on a document camera.
- Make a legend or labels to ensure that which liquid is which is clear to the audience.

Clean-Up Procedures

1. Keep bottles for future use.
2. If not keeping the bottles, rinse water down the drain.
3. Dilute ethanol thoroughly and pour into a waste bottle.
4. Pour hexanes/iodine mixture into a waste bottle.
 - a. Hexane evaporates very quickly; write a warning label to only open the bottle in a fume hood as much will likely have evaporated. Request pick-up promptly and regularly check for any signs of pressurization of the waste bottle.