

INTERMOLECULAR FORCES

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MATERIALS NEEDED:

Iodine (approx. 1 g) (As an alternative, use tincture of iodine, available from a pharmacy)

Water, H₂O

Ethanol, C₂H₅OH

Hexane, C₆H₁₄

Test tubes, 25 x 200 mm or similar (3)

Corks or stoppers to fit the test tubes

Flask, 500-mL or 1000-mL, with a cork to fit the flask.

Burner, to heat flask.

SAFETY PRECAUTIONS:

Wear safety goggles while performing this experiment.

Iodine is toxic. Use only small quantities. Keep containers sealed to minimize fumes.

DISPOSAL:

Dispose of all iodine wastes in the proper receptacles for halogen wastes.

PROCEDURE:

Add a few crystals of iodine to a large flask. Stopper. Heat the flask gently until iodine vapors can be observed.

Add a few crystals of iodine (or a few drops of tincture of iodine) to water in a large test tube. Note the color of the mixture.

Add a few crystals of iodine (or a few drops of tincture of iodine) to ethanol in a large test tube. Note the color of the mixture.

Add a few crystals of iodine (or a few drops of tincture of iodine) to hexane in a large test tube. Note the color of the mixture.

EXPLANATION:

The iodine molecule is non-polar. In the molecular form, iodine vapors are violet.

When mixed with either water or ethanol, the iodine molecules are subjected to polar forces, resulting in an induced polarity in the iodine molecules. This is an example of polar-induced polar intermolecular forces. Thus the solution is brown in color.

When mixed in a non-polar liquid such as hexane, there is no polarity induced in the iodine and the iodine will give a violet color to the solution (Note: the color may be pink if the iodine concentration is low).

To demonstrate the like-dissolves-like principle, carefully add some hexane to the water-iodine mixture and/or the ethanol-iodine mixture. The hexane layer should initially be colorless or lightly pink. Gently shaking the test tube will increase the iodine concentration in the hexane layer. If the test tube is stoppered and shaken, almost all of the iodine will dissolve in the hexane layer leaving the water (or alcohol) layer almost colorless.