

# Cool Liquids

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Hour: \_\_\_\_\_

## Question

Given a set of liquids, which have the strongest intermolecular forces and which have the weakest?

## Safety Precautions

The liquids used in this investigation are flammable liquids and a dangerous fire risk. They are toxic by ingestion or inhalation. Wash hands with soap before leaving the laboratory.

## Knowledge Probe: Pre-Lab Questions

1. Complete the following table:

| Compound | Structural Formula<br>(you'll have to look this up in a textbook or online) | Molar Mass | Polar or Nonpolar?<br>(look at the majority of bonds in the molecule and make an educated guess) | Hydrogen bonding availability? |
|----------|-----------------------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------------|--------------------------------|
| Hexane   |                                                                             |            |                                                                                                  |                                |
| Ethanol  |                                                                             |            |                                                                                                  |                                |
| Methanol |                                                                             |            |                                                                                                  |                                |
| Acetone  |                                                                             |            |                                                                                                  |                                |
| Water    |                                                                             |            |                                                                                                  |                                |

2. Make your best educated guess about the strengths of the intermolecular forces of the liquids in the previous table. Arrange them in order from strongest intermolecular forces to weakest intermolecular forces.
3. What factors did you consider when making your predictions in the previous question? (For example, what do you know about intermolecular forces that influenced your order?)

4. Read the procedure and then, in the data section, create a data table suitable for this experiment.

### **Procedure**

1. In the lab room at separate stations, you will see five test tubes #1-5. Each test tube contains a few milliliters of the appropriate liquid, according to the following table. Stopper the test tubes with corks or rubber stoppers until needed. Choose a station. You don't need to start at Station #1.

| Test Tube | 1      | 2       | 3        | 4       | 5     |
|-----------|--------|---------|----------|---------|-------|
| Solvent   | Hexane | Ethanol | Methanol | Acetone | Water |

2. The thermometers at each station are wrapped with a cotton gauze square. Place the thermometer into the test tube. Make sure the level of the liquid is above the cotton gauze so that the cotton is saturated with liquid. Record the temperature of the liquid.
3. Lift the thermometer out of the liquid and hold it above the test tube so that any dripping liquid falls back into the test tube. Record the temperature right away.
4. Observe what happens to the temperature while you hold the thermometer still, above the test tube. After you believe you've reached the coldest temperature (it may take a few minutes) that you're going to reach, record that temperature.
5. Place the thermometer back on the lab table and stopper the test tube.
6. Repeat the above procedure at each station until you have tested all five liquids. Record the necessary temperatures for each liquid.

**Data** (You'll need to create your own appropriate data table.)

**Conclusion**

**Claim:** (Look at question 2 in the pre-lab section and make a new experimentally verified claim. Order the liquids from strongest to weakest intermolecular forces based on data from this lab.)

**Evidence**

**Reasoning**

