

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## Isopropanol (IPA) Propulsion Student Worksheet

### Introduction

Surface tension is a property of liquids that produces an inward force along the surface of the liquid. Fluids with high surface tensions “bead” as water does when it is poured over a newly waxed car. Isopropanol, in contrast, possesses a low surface tension. This lack of inward force means that when an object is bordered on one or more sides by isopropanol, the isopropanol will exert a greater force against the object than a liquid with a higher surface tension. In this activity, we will attempt to manipulate this property to provide a propulsion system for a centimeter-scale boat.

### Purpose

1. To build a vessel powered by the differing surface tensions of water and isopropanol.
2. To analyze the effect of scale on usefulness of surface tension as a source of propulsion.

### Question(s)

1. How does surface tension affect the way in which a liquid exerts forces on surrounding objects?
2. Why do changes in surface tension affect motion on some scales but not others?

**Hypothesis** Develop a hypothesis to answer one or both of the questions listed above.

### Key Terms

**Surface Tension:** \_\_\_\_\_

### Materials (per class unless otherwise indicated)

- Foam poster board (1/4” thick, standard poster board dimensions)
- Hobby Knife
- 8x10 baking pan (1 per group)
- Micropipette (1 per group)
- Isopropyl Alcohol (2 mL per group)

## Procedure

### A. Preparing the Isopropanol (IPA) Boat

*\*Your teacher may complete this step due to time and safety considerations.*

1. Cut the boat shape shown below out of foam poster board using scissors or a hobby knife.



2. Use a hobby knife to create a well and channel in the boat for carrying and dispensing isopropanol. The well should be approximately 3-4 mm deep and shaped as indicated in the figures below.



### B. Testing the Boats

1. Set up your IPA boat experiment as follows:
  - a. Fill your basin with approximately 1 cm of water.
  - b. Gently place your boat on the surface of the water.
  - c. Using a micropipette, dispense one or two drops of IPA into the well on your boat.
  - d. Complete the questions below and record observations of the motion that is produced as the IPA exits the channel at the rear of the boat.
  - e. Return your materials to their designated locations when your experiment is completed.
2. Observe any visible evidence that a propulsion process is taking place.

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3. Observe and describe the motion that is produced as a result of the reaction. If possible, measure and record the speed of the boat as it moves through the peroxide solution.

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