VECTOR RIVER ACTIVITY

Name: _____

I. **PREPARATION** Period: _____Date: _____

- Assume your constant velocity vehicle travels at approximately 0.4 m/s.
- Practice "pulling" the sheet of newsprint to simulate a constant current in your "river" of approximately 0.3 m/s.
- Draw an inner tube and pink water molecule in your "river".
- Attach a piece of tape on the lab table (or floor) next to the sheet of paper to represent a stationary observer on shore.

II. **PROCEDURE**

In order to help you visualize the relative motion between a boat and a river, a river and the shore, and ultimately the boat and the shore; simulate the conditions in *each* of the following situations. (Assume your river is flowing due South.)

A. **BOAT AT FULL SPEED HEADING DOWNSTREAM**

1.) What is the velocity of each of the following with respect to (as seen by) an observer on the shore?

_____ pink water molecule

_____ inner tube

_____ boat

2.) What is the velocity of each of the following with respect to (as seen by) a person in the inner tube?

_____ pink water molecule

_____ boat

_____ person on shore

Describe a situation in which the observer in the inner tube:

a.) *sees a person on shore stationary with respect to the inner tube*

b.) *sees a person in the boat stationary with respect to the inner tube*

3.) What is the velocity of each of the following with respect to (as seen by) an observer in the boat?

_____ pink water molecule

_____ inner tube

_____ person on shore

B. **BOAT AT FULL SPEED HEADING UPSTREAM**

1.) What is the velocity of each of the following with respect to (as seen by) an observer on the shore?

_____ pink water molecule

_____ inner tube

_____ boat

How must the speed of the current compare with the boat's speed relative to the water so that an observer on the shore would see the boat moving upstream?

_____

Downstream? _____

2.) What is the velocity of each of the following with respect to (as seen by) a person in the inner tube?

_____ pink water molecule

_____ the boat

_____ person on shore

3.) What is the velocity of each of the following with respect to (as seen by) an observer in the boat?

_____ pink water molecule

_____ inner tube

_____ person on shore

What velocity of the boat will cause the person on shore to appear stationary as seen by an observer in the boat? _____

C. BOAT AT FULL SPEED HEADING ACROSS THE RIVER AT A 90 DEGREE ANGLE (ASSUME THE BOAT IS POINTED WEST.)

1.) What is the speed of each of the following with respect to an observer on the shore?

_____ pink water molecule

_____ inner tube

_____ boat

2.) What is the speed of each of the following with respect to (as seen by) an observer in the inner tube?

_____ pink water molecule

_____ boat

_____ person on shore

3.) What is the speed of each of the following with respect to (as seen by) an observer in the boat?[1]

_____ pink water molecule

_____ inner tube

_____ person on shore

[1] Question 3 (in each section of this activity) is the most difficult for students.

III. DETERMINE THE BEST ANSWER FOR THE TWO SITUATIONS BELOW

A. Assume you fell overboard in the middle of the river directly across from the dock where all your friends are waiting for you. Which *general* direction should you swim so that you can climb out of the water onto the dock? Draw two arrows in the picture with one showing the direction the swimmer's effort and the other showing the direction of the swimmer's path relative to the shore. Label each arrow clearly.

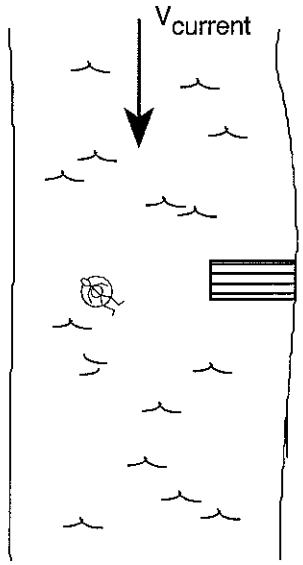

Figure 2.33

B. Assume you fall overboard in the middle of the river again, but this time no one is waiting to greet you. What general direction should you swim to reach the East shore in the *shortest time possible*? (Hint: Think of how you would swim in a swimming pool on a train to get to the side of the pool in the shortest time.) Draw two arrows in the picture again as in the problem above, and label the two arrows clearly.

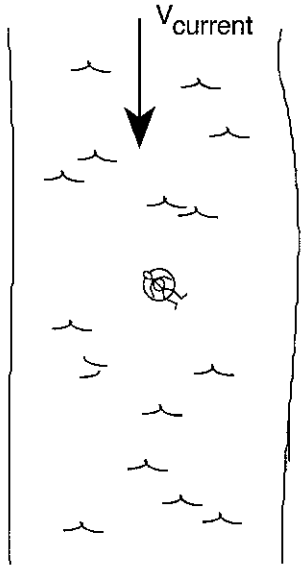

Figure 2.34

IV. CREATE YOUR OWN BOAT PROBLEM

Make up an example in which the boat is not parallel or perpendicular to the current. You should keep the speed of the boat and the current the same as those used in the earlier problems. Draw the picture clearly labeled in the space given. (You may need to make a scale drawing of your vector diagram or solve your problem with trigonometry.)

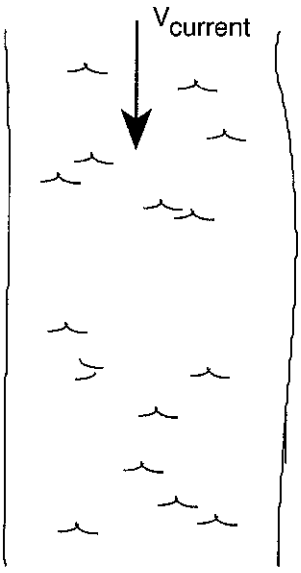

Figure 2.35

1.) What is the velocity of each of the following with respect to an observer on the shore?

_____ pink water molecule

_____ inner tube

_____ boat

2.) What is the velocity of each of the following with respect to an observer in the boat?

_____ pink water molecule

_____ inner tube

_____ person on shore

3.) What is the velocity of each of the following with respect to an observer in the inner tube?

_____ pink water molecule

_____ boat

_____ person on shore