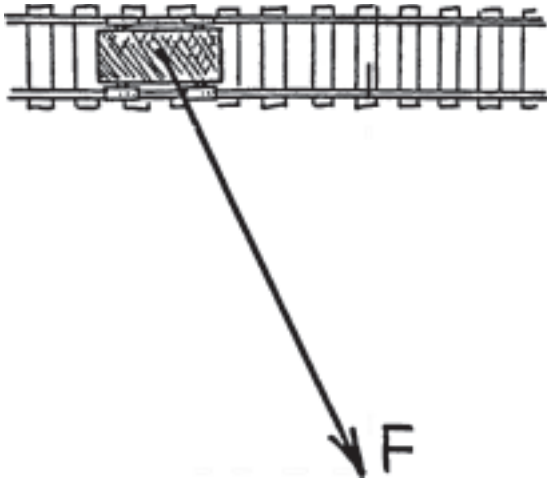
Name _____ Class _____ Date _____

Concept-Development Practice Page **6-6**

Sailboats

(Do not attempt this until you have studied Appendix D!)

1. The sketch shows a top view of a small railroad car pulled by a rope. The force **F** that the rope exerts on the car has one component along the track, and another component perpendicular to the track.



   a. Draw these components on the sketch. Which component is larger?

   _____

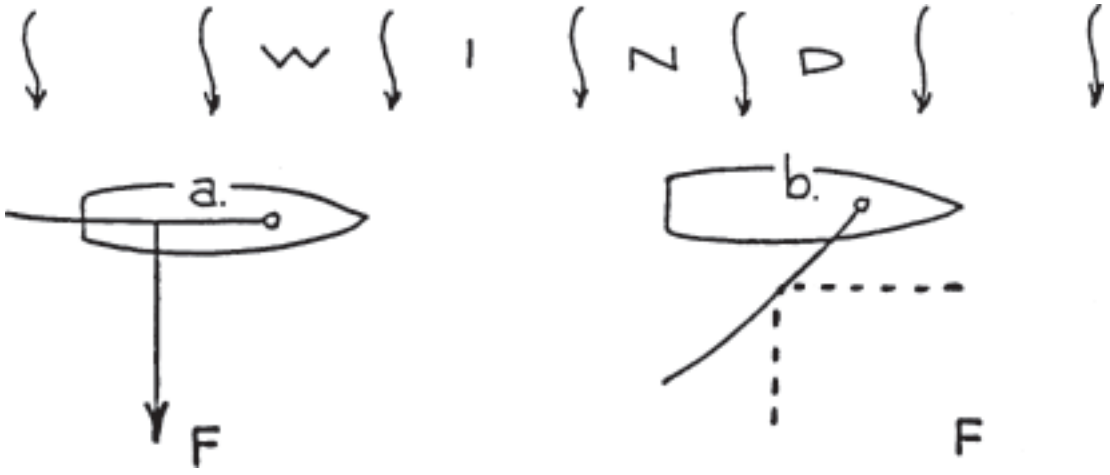
   b. Which component produces acceleration?

   _____

   c. What would be the effect of pulling on the rope if it were perpendicular to the track?

   _____

2. The sketches below represent simplified top views of sailboats in cross-wind direction. The impact of the wind produces a FORCE vector on each as shown. (We do NOT consider *velocity* vectors here!)



   a. Why is the position of the sail above useless for propelling the boat along its forward direction? (Relate this to Question 1c above. Where the train is constrained by tracks to move in one direction, the boat is similarly constrained to move along one direction by its deep vertical fin — the *keel*.)

   _____

   _____

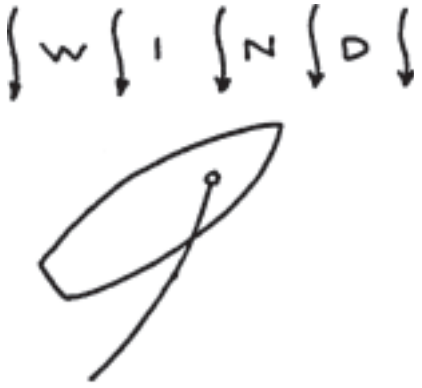
   b. Sketch the component of force parallel to the direction of the boat's motion (along its keel), and the component perpendicular to its motion. Will the boat move in a forward direction? (Relate this to Question 1b above.)

   _____

   _____

CONCEPTUAL PHYSICS

3. The boat to the right is oriented at an angle into the wind. Draw the force vector and its forward and perpendicular components.

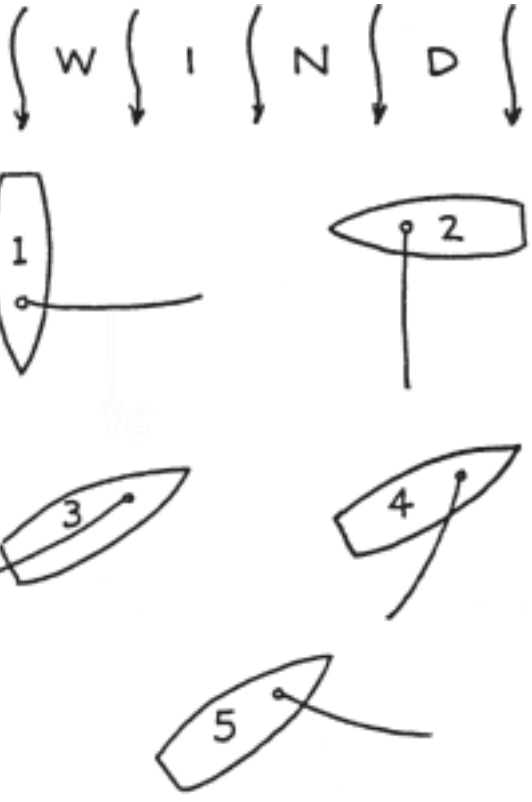


   a. Will the boat move in a forward direction and tack into the wind? Why or why not?

   _____

   _____

4. The sketch below is a top view of five identical sailboats. Where they exist, draw force vectors to represent wind impact on the sails. Then draw components parallel and perpendicular to the keels of each boat.



   a. Which boat will sail the fastest in a forward direction?

   _____

   b. Which will respond least to the wind?

   _____

   c. Which will move in a backward direction?

   _____

   d. Which will experience less and less wind impact with increasing speed?

   _____