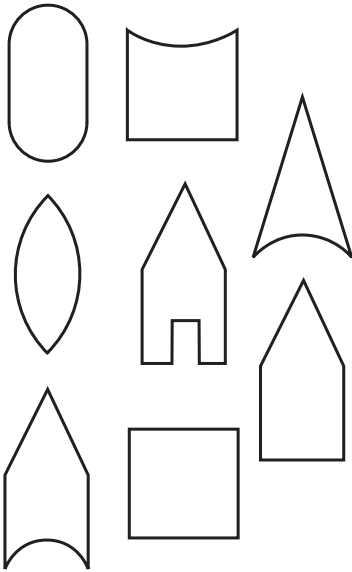


# Teachers' notes

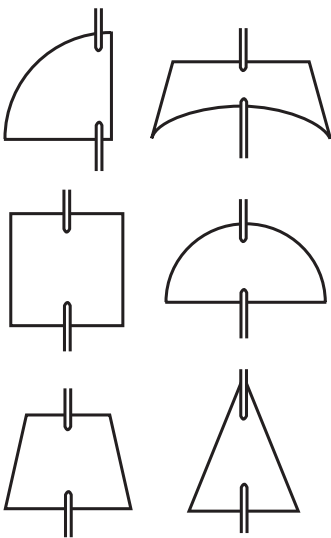
## Boat builder

Explore forces and materials as you design, make and test your own 'sea-faring' vessels

### Hull shapes



### Sail shapes



### Getting started

One of the major questions facing Brunel during the design and construction of his ocean-going ships, was how well these large objects would float and move through the water under power. Gather together a collection of pictures of ships, boats and other water craft, showing a range of different hull shapes.

### Hull shape

Divide the class into groups of two or three children. Provide each group with a large sheet of paper and pencils, and encourage them to design three or four different hull shapes that are about the same size but have different features (see examples, left). Using tracing paper, transfer the designs to balsa or other types of thin, soft wood. Cut out the shapes carefully with a saw and smooth any rough edges with sandpaper.

### Sail away

All of Brunel's large ships had sails as a backup to the engines and/or paddles. Experiment with different shaped sails (see diagrams below left), and also try out a range of materials, including paper, thin card, fabric and plastic sheeting. Attach the sails to masts made from thin garden canes or blunted kebab skewers. Drill a small hole in the wooden hull shapes and hold the masts secure with waterproof glue.

### Test tank

When the models are ready, test them in a suitable water tank to see how well they move and how buoyant they are. One of the easiest ways of making a water tank for use in the classroom is to cut a section of plastic drainpipe about 3m long and mount it on wooden blocks. This will provide a narrow channel that helps keep the prototype boats moving along a straight course (see illustration below). Use a battery-powered fan to provide the 'wind' to move the boats along.

### Extension activities

- Investigate ways of making the wooden hulls more waterproof. Try pastels, wax crayons, and oil- and water-based paints. Which works best?
- Consider improving the stability of the boat by splitting the hull into two parts like a catamaran. Test the stability of the boat by using small weights as cargo.
- Challenge the children to think of other methods of propulsion apart from the wind. For example, you could experiment with elastic bands to create a propeller or paddle-wheel system at the rear of the boat.

