

Wind-powered Car

Key Stage: 2

Strand:

Mathematics: Measures (Learning Unit: 6M3 Speed)

General Studies: Science and Technology in Everyday Life (Core Elements: efficient transfer of energy and the interaction between energy and materials, to design and build models by using different materials and to test selected function of the model built with the chosen material(s))

Objectives:

- (i) To consolidate the concept of speed
- (ii) To recognise the efficient transfer of energy and the interaction between energy and materials
- (iii) To design and build models by using different materials and to test selected function of the model built with the chosen material(s)
(can collaborate with the subject of General Studies)

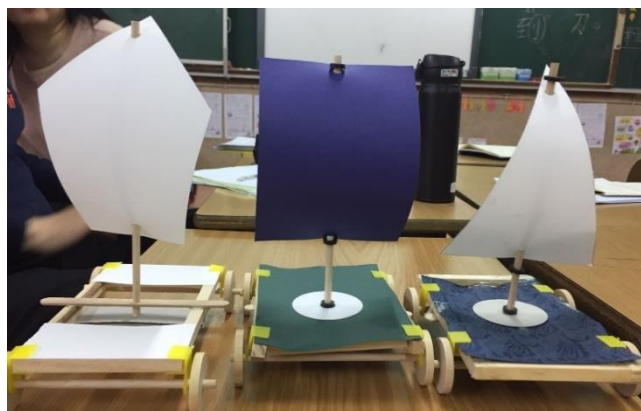
Prerequisite Knowledge: Recognising the relations among speed, time and distance

Resources Required: Rack of wind cars, racetrack for wind cars, air blower, stop watch

Description of the Activity:

Activity 1

1. The teacher asks students to work in groups to assemble the racks of the wind-powered cars.(Figure 1)



(Figure 1)

2. The teacher discusses with students the meaning of a fair test.

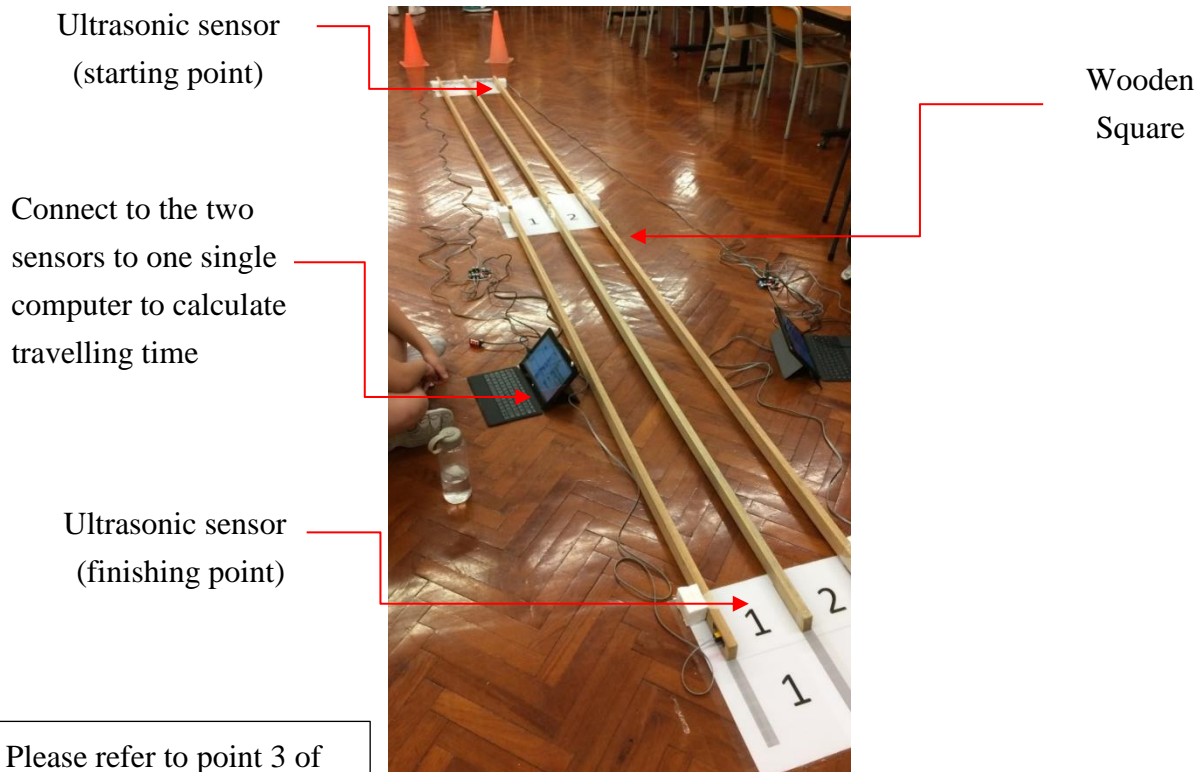
Notes for Teachers:

1. Students may need time to assemble the cars and have discussion. The teachers should adjust the content of the test items according to school's needs and students' ability. For example, when same material is used for the sails, only two sets of testing are required for testing how shapes and areas of sails affect the results.
2. Fair tests can be arranged in the following ways:
 - (i) to test how shapes of sails affect speeds of the cars for the same material and same size of the sails (the 1st experiment);
 - (ii) to test how sizes of sails affect speeds of the cars for the same material and same shape of the sails (the 2nd experiment);
 - (iii) to test how materials of sails affect speeds of the cars for the same size and same shape of the sails (the 3rd experiment).

Finally, the students should discuss which design (material, size and shape) of the sails makes the wind-powered cars the fastest.
3. Teacher can order the same racks of the wind-powered cars for the students so that the fair tests can be well conducted.

Activity 2 (Worksheet 1)

1. The sails of the same material and the same size but of different shapes are made. The cars are placed in the racetrack for the first experiment (Figure 2). The speeds of each set of the wind-powered cars are measured.
2. The teacher and students discuss about the results of the experiments.



(Figure 2)

Questions for discussion:

1. Do the shapes of sails affect the speeds of the wind-powered cars?
2. Do the sizes of sails affect the speeds of the wind-powered cars?

Notes for Teachers:

1. Students select sails of different shapes. The teacher can suggest the variety and the number of the shapes to be selected. Sails of the same material and the same size but of different shapes are made. Information can also be collected for choosing some particular shapes for testing.
2. Racetracks are set for the wind-powered cars to travel along a straight path. A clear finishing line should be drawn for the ease of recording the travelling distances and travelling time of the cars. The teacher may make use of different materials, such as wooden square (Figure 2), for the racetracks.
3. Apart from using stop watch, the teacher can use a mobile phone to record the whole journey of the cars and review the recordings to find out the travelling time of the cars.

The teacher may also use the sensors associated with a coding package to measure the time more accurately.

Activity 3 (Worksheet 2)

1. Select the shapes that give the wind-powered cars the fastest speed according to the first experiment. Install racks of the cars with the sails of the same material and same shape. Do the second experiment and measure the speeds of each set of the cars.
2. The teacher and students discuss about the results of the experiments.

Questions for discussion:

1. Do the sizes of sails affect the speeds of the wind-powered cars?
2. If the size of a sail is getting larger and larger, does the wind-powered car go faster and faster? Why?
3. Do the materials of sails affect the speeds of the wind-powered cars?

Activity 4 (Worksheet 3)

1. Select the shapes and sizes that give the wind-powered cars the fastest speed according to the first and the second experiments. Install racks of the cars with the sails of the same size and same shape but different materials. Do the third experiment and measure the speeds of each set of the cars.
2. The teacher and students discuss about the results of the experiments.

Questions for discussion:

Do the materials of the sails affect the speeds of the wind-powered cars?

Activity 5 (Worksheet 3)

1. Select the “best” sail that give the wind-powered car the fastest speed according to the three experiments.
2. Discuss with students the other factors that affect the results of the experiments.

Questions for discussion:

1. The same experiment is done by each group. Why are the speeds of the product of each group different?
2. Apart from those factors controlled in the several experiments, what other factors may affect the speeds of the wind-powered cars?

Integration and Application:

Technology Education: Model design and choosing appropriate materials

Mathematics Education: Concept of speed and measurement of speed

This example mainly involves the following generic skills:

1. Collaborative Skills
 - Collaborate in groups
 - Share the responsibilities and understand the roles of individual members in the production of wind-powered cars
2. Creativity
 - Improve and refine the designs of the wind-powered cars
3. Problem Solving Skills
 - Try out and improve the solutions through different experiments

Worksheet 1

The first experiment: (Shapes of sail)

1. Do the shapes of sails affect the speeds of the wind cars?

My prediction: _____

2. Under the principle of fair test, if the effect of **the shapes of the sails** towards the speeds of the wind cars is tested, sails of the same _____ and _____ should be used in the testing.

Testing Results:

Shapes of sails Trials	Rectangle length____cm, width____cm	Square side____cm	Triangle height____cm, base____cm
1st			
2nd			
3rd			
Average time			
Average speed			

We discover:

1. From the test results, we find that the shapes of the sails (affect / do not affect) the speeds of the wind cars.
2. The shape _____ gives the fastest speed of the wind cars.

Thinking: The shapes of the sails affect the speeds of the wind cars. Does the area of the sail affect the speed of the wind car?

Worksheet 2

The second experiment: (Area of sail)

1. Do the areas of sails affect the speeds of the wind cars?

My prediction: _____

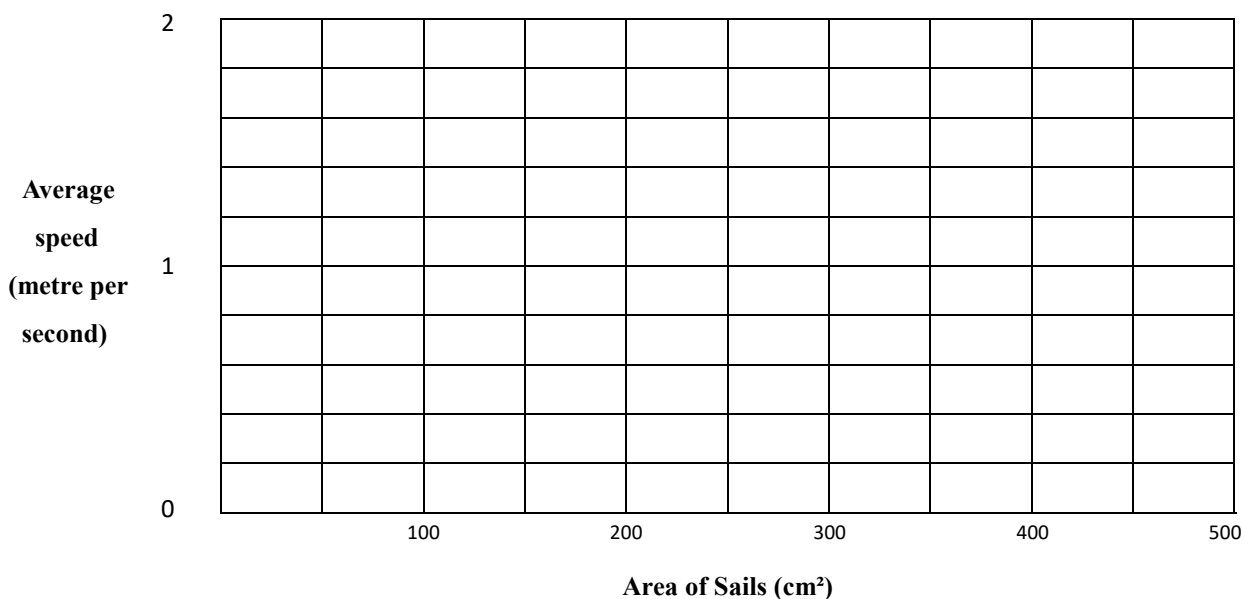
2. Under the principle of fair test, if the effect of **the areas of the sails** towards the speeds of the wind cars is tested, sails of the same _____ and _____ should be used in the testing.

Testing Results:

<div>Areas of sails</div> <div>Trials</div>	____cm ²	____cm ²	____cm ²
1 st			
2 nd			
3 rd			
Average time			
Average speed			

Use the data to construct the following broken line graph.

Average speeds of wind cars with sails of different sizes



We discover:

1. From the test results, we find that the areas of the sails (affect / do not affect) the speeds of the wind cars.
 2. If the size of a sail is getting larger and larger, does the wind car go faster and faster?
Why?
-

Thinking: The areas and shapes of the sails affect the speeds of the wind cars. Do the materials of the sails affect the speeds of the wind cars?

Worksheet 3

The third experiment: (Materials of sail)

1. Do the materials of sails affect the speeds of the wind cars?

My prediction: _____

2. Under the principle of fair test, if the effect of **the materials of the sails** towards the speeds of the wind cars is tested, sails of the same _____ and _____ should be used in the testing.

Testing Results:

Materials of sails Trials	Corrugated Fiberboard	polyester film	Waxed paper	Aluminium foil
1st				
2nd				
3rd				
Average time				
Average speed				

We discover:

1. From the test results, we find that the materials of the sails (affect / do not affect) the speeds of the wind cars.
2. The sail made by _____ (material) gives the wind car of the fastest speed.
3. Why does the sail of this material give faster speed of the wind car?
