Teacher notes: Pit stop

Introduction:

The Pit stop activities are designed to motivate students to investigate the performance of model solar cars through a series of racing challenges.
To do this activity you will need a set of model solar racing cars these are often shared between design technology and science departments.
More about the solar car kits used here and a range of STEM based educational resources can be found at www.solar-active.com

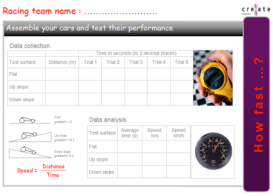
We recommend using solar cars in natural daylight as solar cells are optimised to work in this quality of light. Using a solar car under artificial lighting conditions will compromise performance.
Before starting racing pupils will need time to construct and test their model cars.

Core Activity: How fast …?: Students first work in racing teams (small groups) to assemble and time the cars on the flat, up a slope and down a slope. Five time trials are conducted for each test surface with the objective of calculating the average speed. It is suggested to use a slope with gradient of 1:10 [10%] for the up slope / down slope trials. There is scope to discuss the many ways in which a gradient can be displayed i.e. ratio, percentage, decimal, angle. Road sign gradients are shown as either a ratio or percentage.

The number of wheel rotations per distance travelled can also be explored.

The results are then used in the *Race your car* activity.

Equipment per group:



Activity sheet: How fast?

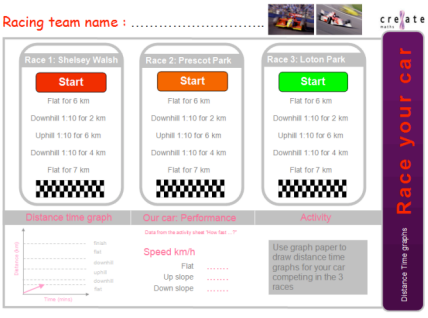
car

Ramp. We suggest using cardboard propped by books to achieve the desired gradient.

tape measure

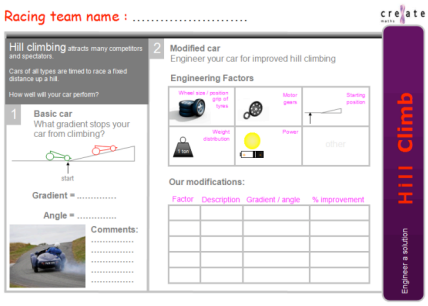
stopwatch

Race your car: Using the speeds calculated in the activity *How fast…?,* the racing teams assess how well their car will perform in three races. Distance time graphs are used to display the car's performance. How long does it take for your car to complete each race?



Teacher notes: Pit stop

Hill climb: Using the basic car, without improvements, students investigate the maximum slope the car will climb. Students then re-engineer the car for improved hill climbing. Factors to explore include wheel size, wheel position, grip of wheels, gears, starting position, weight distribution and power source output. The percentage improvement can be calculated.

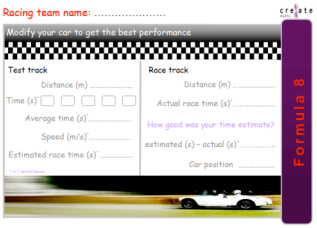


Hill climb extension:
How are the *gradient of hill* and *time to travel* related? How are the *gear ratio* and *time to travel* related? Start with a class discussion, then allow students to study the relationship using suitable scatter graphs.

Formula 8: Students modify their cars for increased speed. Gears, body kits, weight loss / gain, wheel size including surface contact area can all be modified. An assessment of the cars speed is made on the test track before team cars are raced on the Formula 8 race track .

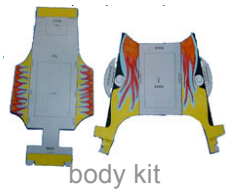
The 'Formula 8' track can be a suitable outdoor space wide enough to race cars on an appropriate surface. The key factor here is that the track is 8 metres long giving opportunity to compare results across different groups. Pupils could even compare their results racing on different surfaces or at different times of the day.

Equipment per group:



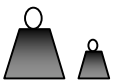
Activity sheet: Formula 8


car


body kit


tape measure


gears


weights


rubber bands


stopwatch

Body kit templates are either provided with the car kits or can be downloaded from www.solar-active.com .

The Mathematics

Within the *How fast…?* and *Hill climb* activities there is scope to discuss the many ways in which a gradient can be displayed i.e. ratio, percentage, decimal, angle. Time and distance data is collected to calculate the car's speed for the various surfaces and the results used throughout other activities. Distance time graphs motivate interesting discussion of the cars racing performance over different race tracks in the *Race you car* activity. Bringing it all together the Formula 8 race meeting involves estimation, collecting race times and determining the finishing position.