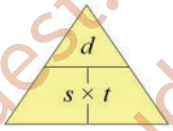
Motion, Distance, Time & Force

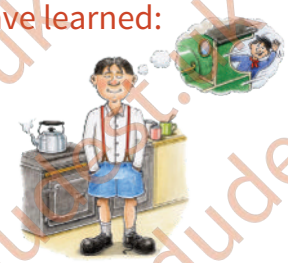
STUDENT INTRODUCTION

- Forces are in action everywhere at the Isle of Wight Steam Railway. The locomotive steam engine, the wheels and rails, the water tower, the signal-box…
- This activity enables you to work out the average speed of the train based on distance and time

You will apply the formula you have learned:

Speed = distance ÷ time





You will need:

- To know the length of the track between the two points you are measuring
- Something to measure the time, i.e. stop-watch or smartphone app

Finding the average speed

- You will then need to time how long [illegible] the calculation of **distance ÷ time** to work out the **average speed** of the train

Task

- On the graph paper provided (on page 3) draw a graph plotting your journey - if you make two journeys, record both (on your graph in different colours) to form an average later

Questions

1. The train starts off slowly then the speed increases. It slows down as it gets into the station. How can this be shown on your graph?

2. If the train has to stop for an emergency for 5 minutes, how would you show this on your graph?

3. What was the average speed in both kilometres per hour and miles per hour? (mph x 1.609344 = kph)

Forces

- If there are no forces having an effect on an object that is moving, it will carry on moving at the same speed.
- On Earth it is almost impossible to find something unaffected by forces.
- Moving objects usually have air resistance or friction acting upon them.
- If the train is moving at a steady speed, air resistance and friction are trying to slow it down. The forward force from its engine is the same size as the total force from air resistance and friction.
- Balanced forces cannot make something start or stop moving or change its speed.

Force diagrams use sized arrows to show:

- the size of the force (the longer the arrow, the bigger the force)
- the direction in which the force acts

- In the case of the train, if the forces are unbalanced it will change speed.
- If the forward force from the engine of the train is bigger than the forces of friction and air resistance, then the train will accelerate.

Questions

5. In the diagram above, what is happening to the movement of the train?

6. Are there any other forces acting on the train? What are they?
(add these using force arrows to the diagram above)