Speeding up

1. The table shows the time taken by five athletes to run a 100 m race.

<table>
<thead>
<tr>
<th>Athlete</th>
<th>Time in seconds (s)</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jo</td>
<td>11.8</td>
<td></td>
</tr>
<tr>
<td>Pat</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Chris</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>Nita</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>George</td>
<td>12.0</td>
<td></td>
</tr>
</tbody>
</table>

a. Complete the last column to show the order in which the athletes finished the race.

b. What was Pat’s average speed? 

c. Was Pat’s top speed more than, less than or equal to your answer to b?

d. Why would a hand-held stopwatch not give accurate enough times for this race?

2. Draw lines to match each force with its correct meaning.

<table>
<thead>
<tr>
<th>Force</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight</td>
<td>the force due to a moving object displacing air molecules</td>
</tr>
<tr>
<td>thrust</td>
<td>a force that opposes motion</td>
</tr>
<tr>
<td>friction</td>
<td>the force on an object due to gravity</td>
</tr>
<tr>
<td>air resistance</td>
<td>a forward pushing force</td>
</tr>
</tbody>
</table>

3. Complete the following sentences. Choose from the words below to fill the gaps.

If all the forces acting on an object are balanced, the object is either balanced or moving at a constant speed.

The force of weight acting on an object gives it weight. This force acts downwards.

If an object is falling through the air, a force called air resistance acts in the downwards direction on it.
K Speeding up (continued)

4 Look at the diagrams of a submarine. The forces acting on it are represented by arrows, and the length of each arrow is proportional to the size of the force. The submarine starts from rest.

Under each diagram, circle the word or words that describe its direction of motion when the forces shown are acting on it.

- a up down forwards backwards
- b up down forwards backwards
- c up down forwards backwards
- d up down forwards backwards

5 Modern cars are designed to have a streamlined shape so that they can go faster.

a What force does streamlining reduce?

b How does this allow the car to go faster?

c What can you say about the forces on a car when it has reached its top speed?

d Why does streamlining increase the top speed of a car?
6 The diagrams show a skydiver in free fall and after her parachute has opened.

a Show the weight of the skydiver in each diagram with an arrow labelled W.

b Show the force of air resistance in each diagram with an arrow labelled R.

c Complete the following sentences by crossing out the incorrect words.

i Weight W increases/decreases/stays the same when the parachute opens.

ii Air resistance R increases/decreases/stays the same when the parachute opens.

iii The speed increases/decreases/stays the same when the parachute opens.

iv When weight equals air resistance, the speed increases/decreases/stays the same.

7 The distance-time graph describes the motion of a car.

a How far does the car travel in 4 s?

b Find the speed of the car during the first 4 s.

c What happens between 4 s and 6 s?

d Draw a line on the graph to show the motion of a different car that, during the first 4 s, travels at half the speed of the original car.