Integrated Science Stage 1
Work Samples

Science is one method of solving problems. Scientists will generally follow a certain procedure when trying to find answers to problems. This procedure is commonly referred to as the scientific method of solving problems. The basic steps used by scientists are set in the following sequence:

(i) initial observation
(ii) hypothesis
(iii) experiment
(iv) data analysis
(v) conclusion.

**Question 1**

What is a hypothesis?

**Question 2**

Write a hypothesis that might account for the following observation. On warm days when the temperature is between 20 to 30 degrees celsius, a certain species of ant is observed to be very active on the surface of the ground.

A biology student set out to investigate the reason why the ants were active when the temperature was quite warm. A controlled experiment was designed in which groups of ants were subjected to different temperatures. The following data were collected.

<table>
<thead>
<tr>
<th>Temperature of the container (°C)</th>
<th>Number of ants active</th>
<th>Number of ants inactive</th>
<th>Total Number of ants in the container</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>46</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>8</td>
<td>42</td>
<td>50</td>
</tr>
<tr>
<td>20</td>
<td>18</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>25</td>
<td>40</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>48</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>35</td>
<td>11</td>
<td>39</td>
<td>50</td>
</tr>
<tr>
<td>40</td>
<td>2</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>45</td>
<td>0</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
**Question 3**
What hypothesis could the biology student have been testing?

**Question 4**
In the above experiment which is the:

(i) independent variable?  
(ii) dependent variable?

**Question 5**
What variables would the biology student need to control in order to collect reliable data?

**Question 6**
Study the data carefully. How would you interpret the data collected by the biology student?

**Question 7**
Does the data support the hypothesis which the student set out to test?

**Question 8**
Is there any data that made you feel uneasy in answering question 7?

**Question 9**
Given your answer to question 8, what conclusion can you make as a result of the above experiment?

**Question 10**
Is (are) there any way(s) to improve this experiment?
**Question 1**

When a skateboard launches onto a skate ramp as shown in the diagram below, the skateboard eventually loses speed and will eventually stop at the bottom of the ramp. Explain the forces that are impacting on the skateboarder and why you think that he may lose speed.

![Diagram of skateboard launch and stop]  

Started from A  

Finishes at a stop at the base of the ramp (C)

**Question 2**

Our drying climate has seen dam inflows reduced dramatically, with the past five years the driest on record in the south-west. This has meant that other sources of water, particularly those that do not rely on rainfall (e.g. recycled water) are now needed to accommodate this new future. Describe what is meant by recycled water.
**Question 3**

**Equations:**

\[
\text{Acceleration} = \frac{\text{Final velocity} - \text{Initial velocity}}{\text{Time}}
\]

\[
\text{Time} = \frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{Acceleration}}
\]

\[
\text{Final Velocity} = \text{Acceleration} \times \text{Time} + \text{Initial Velocity}
\]

1. A roller coaster car rapidly picks up speed as it rolls down a slope. As it starts down the slope, its speed is 4 m/s. But 3 seconds later, at the bottom of the slope, its speed is 22 m/s. What is its average acceleration?

2. A cyclist accelerates from 0 m/s to 8 m/s in 3 seconds. What is his acceleration? Is this acceleration higher than that of a car which accelerates from 0 to 30 m/s in 8 seconds?

3. A car advertisement states that a certain car can accelerate from rest to 70 km/h in 7 seconds. Find the car’s average acceleration.
Question 4

The following table shows the approximate reaction distances, braking distances and stopping distances at various speeds for a car in good condition on a dry bitumen road.

A reaction time of 1 second has been assumed.

<table>
<thead>
<tr>
<th>Speed (km h⁻¹)</th>
<th>Reaction distance (m)</th>
<th>Braking distance (m)</th>
<th>Stopping distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>60</td>
<td>16</td>
<td>20</td>
<td>36</td>
</tr>
<tr>
<td>90</td>
<td>24</td>
<td>45</td>
<td>69</td>
</tr>
<tr>
<td>120</td>
<td>32</td>
<td>80</td>
<td>112</td>
</tr>
</tbody>
</table>

(a) Use the above information to draw graphs in the grid below to show how reaction distance and braking distance change as speed increases.

(b) Describe the difference between reaction distance and braking distance from the information on your graph.

(c) Describe two measures being implemented to decrease the risk of a crash due to speeding.