13+ Entry Examination

Sample Test

SCIENCE

Time allowed: 60 minutes

To be filled in by pupil:

Name:

Current School:

To be filled in by marker

Total Mark: /86

Percentage:
Introduction

The following examination paper has been constructed from past SATs papers.

Questions are chosen to test skills in science thinking and application. The context of any question must be based around different areas in science (Biology, Chemistry and Physics) but the majority of marks awarded make use of information given in the question combined with the application of your scientific skills to use this information as well as your own scientific awareness.

There are 14 questions in the test, many with several parts. **If you get stuck with a question move on to look at the others and try to finish as many as you can.** Keep going until you see the message below:

“The End!
You have finished!

Well done – if you have time go back and check answers or fill in any missing gaps!”

Notes:

- Attached to this sample paper is a mark scheme which indicates how marks will be awarded
- We are looking for knowledge, understanding and, most importantly, academic potential in the sciences. In that respect we hope the paper is challenging but also enjoyable!
Q1. Harry mixed zinc with copper sulphate solution in a test-tube. A displacement reaction took place and the temperature increased.

(a) The word equation for the reaction is shown below.

\[ \text{zinc} + \text{copper sulphate} \rightarrow \text{zinc sulphate} + \text{copper} \]

Why is this reaction called a displacement reaction?

...............................................................................................................................................................
...............................................................................................................................................................

1 mark

(b) Harry repeated the experiment with two other metals. He wanted to calculate the temperature rise each time. His results are shown below.

<table>
<thead>
<tr>
<th>metal added to copper sulphate</th>
<th>temperature at the start (°C)</th>
<th>highest temperature reached (°C)</th>
<th>rise in temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>zinc</td>
<td>20.0</td>
<td>36.5</td>
<td>16.5</td>
</tr>
<tr>
<td>iron</td>
<td>25.5</td>
<td>38.5</td>
<td>13.0</td>
</tr>
<tr>
<td>magnesium</td>
<td>19.5</td>
<td>87.5</td>
<td>68.0</td>
</tr>
</tbody>
</table>

Harry used different starting temperatures. Explain why this did not affect his results.

...............................................................................................................................................................
...............................................................................................................................................................

1 mark
(c) Part of the reactivity series of metals is shown below.

<table>
<thead>
<tr>
<th>most reactive</th>
<th>sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>calcium</td>
</tr>
<tr>
<td></td>
<td>magnesium</td>
</tr>
<tr>
<td></td>
<td>aluminium</td>
</tr>
<tr>
<td></td>
<td>zinc</td>
</tr>
<tr>
<td></td>
<td>iron</td>
</tr>
<tr>
<td>least reactive</td>
<td>copper</td>
</tr>
</tbody>
</table>

Use the reactivity series above to answer all the questions below.

(i) Why was the highest rise in temperature obtained with magnesium and copper sulphate?
................................................................................................................
................................................................................................................

................................................................................................................

................................................................................................................

1 mark

(ii) Why was the rise in temperature obtained with zinc and copper sulphate not much higher than the rise in temperature obtained with iron and copper sulphate?
................................................................................................................
................................................................................................................

................................................................................................................

................................................................................................................

1 mark

(iii) In which of the following mixtures would there be a rise in temperature? Write yes or no in each blank box.

<table>
<thead>
<tr>
<th>mixture</th>
<th>Would there be a rise in temperature?</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium + sodium chloride</td>
<td></td>
</tr>
<tr>
<td>calcium + zinc sulphate</td>
<td></td>
</tr>
<tr>
<td>lead + zinc chloride</td>
<td></td>
</tr>
<tr>
<td>magnesium + iron chloride</td>
<td></td>
</tr>
</tbody>
</table>

2 marks
maximum 6 marks
Q2. Joanne burnt four different crisps. She predicted that the bigger the crisp, the longer it will burn.

(a) Look at the picture above. What did Joanne wear to protect herself?

.............................................................

1 mark

(b) Joanne measured the time taken for each crisp to burn completely. The bar chart shows Joanne’s results.

Look at the bar chart. How much time did crisp D take to burn?

...................... seconds

1 mark
(c) The crisps Joanne used in her investigation are shown below.

![Crisps A, B, C, D]

(i) Joanne predicted that the bigger the crisp, the longer it will burn. Do the results support Joanne’s prediction? Tick one box.

- yes [ ]
- no [ ]

Use Joanne’s results to explain your answer.

.............................................................................................................

.............................................................................................................

1 mark

(ii) How can you tell that Joanne did not carry out a fair test?

.............................................................................................................

1 mark

(d) Joanne wrote some conclusions for her investigation.

Decide whether each conclusion is true, false, or you cannot tell. Tick the correct box for each conclusion.

<table>
<thead>
<tr>
<th>conclusion</th>
<th>true</th>
<th>false</th>
<th>cannot tell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two crisps took the same amount of time to burn.</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>The smallest crisp burnt for the shortest time.</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Two of the crisps burnt with flames of the same size.</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

3 marks maximum 7 marks
Q3. Josh has a helium-filled balloon.

(a) He wants to calculate the speed of his balloon as it rises to the ceiling.

(i) What two measurements should he take to calculate the average speed of his balloon?

1 .........................................................................................................................

2 ......................................................................................................................... 1 mark

(ii) How can he use these measurements to calculate the speed of his balloon?

.............................................................................................................................

............................................................................................................................. 1 mark

(b) Josh attached different masses to his balloon. For each mass, he calculated the speed of rise of the balloon. His results are shown below.

<table>
<thead>
<tr>
<th>mass (g)</th>
<th>speed of rise (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>120</td>
</tr>
<tr>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>30</td>
<td>–20</td>
</tr>
<tr>
<td>40</td>
<td>–70</td>
</tr>
</tbody>
</table>
(i) How does the table show that the balloon went downwards?

........................................................................................................................................

1 mark

(ii) Josh plotted two points on the graph as shown. Complete the graph by plotting the missing points and draw a line of best fit.

From the graph, find the mass needed to keep the balloon floating in one place.

............ g

1 mark

maximum 6 marks
Q4. Some pupils investigated different materials used to make rucksacks. Here are some of the questions they asked.

(a) Which pupil asked a question that cannot be investigated? Tick the correct box.

Aysha  Philip  Zoe  Shaun

Give a reason to your answer.

........................................................................................................................................

........................................................................................................................................

2 marks

(b) Zara took four different rucksack materials and investigated how waterproof they were.

She poured 100 cm$^3$ of water through each material in turn.
She measured the volume of water passing through each material in 30 minutes.

(i) Give one way of making Zara’s test fair.

........................................................................................................................................

1 mark

(ii) Look at the photograph of the investigation. Name one measuring instrument Zara used.

........................................................................................................................................

1 mark
(c) The table below shows Zara’s results.

<table>
<thead>
<tr>
<th>material</th>
<th>volume of water passing through each material (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>11</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
</tr>
</tbody>
</table>

Which material was the most waterproof?
Tick the correct box.

A  [ ]  B  [ ]  C  [ ]  D  [ ]

Explain your answer.

........................................................................................................................
........................................................................................................................

2 marks
maximum 6 marks

Q5. Jason wanted to find out if hair dye makes hair weaker.
He used 5 hairs of equal length.
He soaked each hair in a different concentration of hair dye for 15 minutes.
He added masses to each hair until it broke.
(a) The table below shows Jason’s results.

(i) Plot a graph of Jason’s results and draw a line of best fit.

<table>
<thead>
<tr>
<th>concentration of hair dye (%)</th>
<th>mass needed to break the hair (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>71</td>
</tr>
<tr>
<td>0.8</td>
<td>67</td>
</tr>
<tr>
<td>1.2</td>
<td>64</td>
</tr>
<tr>
<td>1.6</td>
<td>61</td>
</tr>
<tr>
<td>2.0</td>
<td>58</td>
</tr>
</tbody>
</table>

(ii) Use the graph to work out the mass needed to break hair soaked in water (0% hair dye).

............... g

3 marks

(b) What was the independent variable that Jason changed in this experiment?

......................................................................................................................

1 mark

(c) What was the dependent variable that Jason measured in this experiment?

......................................................................................................................

1 mark
(d) What is the relationship between the concentration of hair dye and the mass needed to break the hair?

........................................................................................................................................

........................................................................................................................................ 1 mark

(e) Jason wanted to investigate whether soaking hair in dye for different amounts of time affected the strength of the hair. Jason drew a table for his results. Add headings **and** units to the table below for Jason’s investigation.

<table>
<thead>
<tr>
<th>heading 1</th>
<th>heading 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(........)</td>
<td>(........)</td>
</tr>
</tbody>
</table>

4 marks
maximum 11 marks
Q6. Richard wanted to find out the best conditions for growing lettuce plants. He took 4 trays and planted 8 lettuce plants in each. The results of his investigation are shown below.

<table>
<thead>
<tr>
<th>variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>tray</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
</tbody>
</table>

(a) How many days did Richard’s investigation last? Use the table to help you.

........................ days

(b) Look at the table. Which variables did Richard change in his investigation? Tick the correct box.

light level and air temperature

soil moisture and type of soil

air temperature and soil moisture

type of soil and light level
(c) Richard said:

Lettuce plants grow better at a medium light level than at other light levels

Why is Richard **not** able to make this conclusion from his investigation?

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1 mark

(d) The table below shows the number of lettuce plants alive at the end of day 1 and day 7 of the investigation.

For each tray, A, B, C and D, suggest the number of plants that were alive on **day 4**. Write your answers in the table below.

<table>
<thead>
<tr>
<th>tray</th>
<th>day 1</th>
<th>day 4</th>
<th>day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

2 marks

maximum 5 marks
Q7. Abi investigated how adding salt to water affects the way an object floats. She used the apparatus below.

She used a scale inside a test-tube to measure the length of the test-tube above the water level.

(a) What factor did Abi change as she carried out her investigation (the independent variable)?

.............................................................................................................................................. 1 mark

(b) Abi plotted her results on a graph.
(i) **On the graph**, circle the result which does **not** fit the pattern.

(ii) **Suggest one** reason for this result.

........................................................................................................................................
........................................................................................................................................

2 marks

(c) Abi said she should repeat the measurement that does **not** fit the pattern. Robert said there is **no** need to repeat this measurement.

Who do you agree with?
Tick **one** box.

Albi... □ □ Robert... □ □

Explain your answer.

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........................................................................................................................................
........................................................................................................................................

1 mark

(d) Abi and Robert wrote the conclusions listed below.

Look at the graph of their results and tick whether each conclusion is **true** or **false** or whether you **cannot tell**.

<table>
<thead>
<tr>
<th>conclusions</th>
<th>true</th>
<th>false</th>
<th>cannot tell</th>
</tr>
</thead>
<tbody>
<tr>
<td>The more salt added, the higher the test-tube floats in the water.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>The length of the test-tube is 8 cm.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>When 10 g of salt is added, the length of the test-tube above the water will be 34 mm.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Doubling the amount of salt doubles the length of the test-tube above the water.</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

2 marks maximum 6 marks
Q8. Jenny put a spring over a wooden rod. She pressed the spring down 2cm.

She let go of the spring and measured the height it reached.

Jenny repeated her experiment. She pressed the spring down more each time. Her results are shown in the graph below.
(a) Use Jenny’s graph to complete the table below.

<table>
<thead>
<tr>
<th>distance the spring was pressed down (cm)</th>
<th>height the spring reached (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

1 mark

(b) Jenny said, ‘If I double the distance I press the spring down, the height it reaches will also double’.

How do the results show she was wrong?

........................................................................................................................................
........................................................................................................................................

1 mark

(c) This diagram shows the moving spring in three different positions.

![Diagram of spring in three positions]

Complete the sentences below by choosing words from the box. You can use each word more than once.

most  some  least

(i) When the spring is moving at B it has kinetic energy and

.......................................... gravitational potential energy.

1 mark
(ii) When the spring reaches C it has ....................... gravitational potential energy and ......................... kinetic energy.

1 mark

(iii) When the spring stops at A it has ......................... kinetic energy and ................................. gravitational potential energy.

1 mark

maximum 5 marks
Q9. Sally investigated how the human body digests and absorbs starch.

She used saliva to digest the starch.

To model digestion she used special bags made from a semi-permeable membrane. These bags have lots of very small holes.

Sally sets up the equipment as shown below. There is one special bag in each beaker.

She keeps the water in the beakers at 37ºC.
After 20 minutes, Sally tested the contents of each beaker and bag for starch and sugar.
The table below shows Sally’s results.

<table>
<thead>
<tr>
<th></th>
<th>Was starch found in the bag?</th>
<th>Was sugar found in the bag?</th>
<th>Was starch found in the water?</th>
<th>Was sugar found in the water?</th>
</tr>
</thead>
<tbody>
<tr>
<td>beaker A</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>beaker B</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>beaker C</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

(a) Suggest why Sally kept the water at 37ºC.

................................................................................................................................................... 1 mark

(b) (i) Explain why sugar was found in the bag in beaker A.

................................................................................................................................................... 1 mark

(ii) Starch was not found in the water outside the bag in any beaker. Suggest why.

................................................................................................................................................... 1 mark
(c) Why did Sally set up beaker C? Tick the correct box.

<table>
<thead>
<tr>
<th>for a fair test</th>
<th>for accuracy</th>
<th>for reliability</th>
<th>for a control</th>
</tr>
</thead>
</table>

1 mark

(d) Sally used diagrams to show what happened in her investigation.

Key: 
- Starch
- Sugar
- Wall of bag

Use the diagrams above to answer the following questions.

(i) Which diagram shows the results of beaker B? Write the letter.

.................................

1 mark

(ii) Which diagram shows the results of beaker A? Write the letter.

.................................

1 mark

(e) What does saliva contain that causes starch to change in beaker A?

......................................................................................................................

1 mark

(f) Sally chewed a piece of bread for 5 minutes without swallowing. What would she notice about the taste of the bread after chewing for 5 minutes? Use Sally’s results to help you.

......................................................................................................................

1 mark
Q10. Simon made two candles from the same amount of wax. He drew lines on both candles.

(a) What would Simon use to measure the distance between the lines?

..........................................

1 mark

(b) He timed how long candle 1 took to burn. His results are shown below.

(i) How long would it take for candle 1 to burn from C to D?
Write your answer in the table.

<table>
<thead>
<tr>
<th>part that burned</th>
<th>time for candle 1 to burn (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to B</td>
<td>30</td>
</tr>
<tr>
<td>B to C</td>
<td>30</td>
</tr>
<tr>
<td>C to D</td>
<td></td>
</tr>
<tr>
<td>D to E</td>
<td>30</td>
</tr>
</tbody>
</table>

1 mark
(ii) Simon timed how long **candle 2** took to burn.

How long would it take for **candle 2** to burn from A to B and from D to E? Write your answers in the table.

<table>
<thead>
<tr>
<th>part that burned</th>
<th>time for candle 2 to burn (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to B</td>
<td></td>
</tr>
<tr>
<td>B to C</td>
<td>20</td>
</tr>
<tr>
<td>C to D</td>
<td>40</td>
</tr>
<tr>
<td>D to E</td>
<td></td>
</tr>
</tbody>
</table>

2 marks

(c) Simon wanted to use a candle to measure time. He made **candle 3** the same size as **candle 1**.

Why is **candle 3** more useful than **candle 1** for measuring time?

........................................................................................................................

........................................................................................................................

1 mark

maximum 5 marks
Q11. The table below shows the number of boats used for catching herring fish in the Norwegian Sea between 1963 and 1967.

<table>
<thead>
<tr>
<th>year</th>
<th>number of fishing boats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>16</td>
</tr>
<tr>
<td>1965</td>
<td>284</td>
</tr>
<tr>
<td>1967</td>
<td>326</td>
</tr>
</tbody>
</table>

The bar chart below shows the total mass of herring caught in the Norwegian Sea between 1963 and 1967.

Use the information above to help you answer parts (a) (i), (ii) and (iii).

(a)  
(i) Why did the mass of herring caught increase between 1963 and 1965?
...............................................................................................................
...............................................................................................................
...............................................................................................................

(ii) Suggest why the mass of herring caught decreased between 1965 and 1967.
...............................................................................................................
...............................................................................................................
...............................................................................................................

1 mark
(iii) Herring cannot breed until they are four years old. Fishing for herring was banned in the Norwegian Sea from 1972 to 1976. Suggest one reason why fishing for herring was banned for this period.

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.............................................................................................................

1 mark

(b) The diagram below shows a food web in the Norwegian Sea.

(i) How could a decrease in the number of herring cause a decrease in the number of sand eels?

.............................................................................................................
.............................................................................................................

1 mark

(ii) How could a decrease in the number of herring cause an increase in the number of sand eels?

.............................................................................................................
.............................................................................................................

1 mark maximum 5 marks
Q12. Amena described her idea about the evaporation of water.

(a) Write a plan for an investigation you could carry out in the school laboratory to test Amena's idea. Assume you have access to all the usual laboratory equipment.

In your plan you must write:

- the one factor you would change as you carry out your investigation (the independent variable)
- the effect you would observe or measure as you carry out your investigation (the dependent variable)
- one factor you would keep the same to help make your test fair.

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3 marks
(b) In the box below, draw and label a table that you could use to record your results.
Q13. Alex makes an electromagnet.
She winds insulated wire around an iron nail.
She connects the wire to a power supply.
She uses the electromagnet to pick up some steel paper-clips.

This is her prediction.

**The more turns of wire around the iron nail the stronger the electromagnet becomes.**

(a) (i) Give the one factor she should change as she investigates her prediction.

.............................................................................................................
............................................................................................................. 1 mark

(ii) Give one factor she should keep the same.

.............................................................................................................
............................................................................................................. 1 mark

(iii) Describe how she could use the paper-clips to measure the strength of the electromagnet.

.............................................................................................................
............................................................................................................. 1 mark
(b) Alex wrote a report of her investigation.

My report

My results are accurate because I can’t see any odd results.

What would an odd result suggest?

......................................................................................................................

......................................................................................................................

......................................................................................................................

1 mark

(c) (i) Which size paper-clips would Alex use to make her results more accurate?

Tick the correct box.

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1 mark

(ii) Give a reason for your choice.

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1 mark

maximum 6 marks
Q14. A cyclist and a runner have a race. The distance-time graph for the race is shown below.

Use the graph to answer the following questions.

(a) (i) How much time did it take the cyclist to travel 100 m?

.......... s

1 mark

(ii) When the cyclist finished the race how far behind was the runner?

.......... m

1 mark

(iii) How much more time did the runner take compared with the cyclist to complete the race?

.......... s

1 mark
(b) The cyclist is travelling at a constant speed between 3 seconds and 6 seconds. How does the graph show this?

........................................................................................................................................
........................................................................................................................................

1 mark

c) (i) When the race started, a walker set off at a steady speed of 2m/s. Draw a line on the graph on the opposite page to show the distance covered by the walker in the first 15 seconds. Use a ruler.

1 mark

(ii) Calculate how much time it will take for the walker to walk 100m.

........................................................................................................................................
........................................................................................................................................... s

1 mark

maximum 6 marks

The End!

You have finished!

Well done – if you have time go back and check answers or fill in any missing gaps!
Whitgift School

13+ Entry Examination

Sample Test

SCIENCE

Time allowed: 60 minutes

MARK SCHEME
M1. (a) any one from
  
  • zinc displaces copper from the copper sulphate
  
  • zinc changes places with copper
    accept ‘copper is displaced by the zinc’
    accept ‘the more reactive metal displaces or takes the place of the other one’
    accept ‘zinc takes the sulphate’

(b) • he only needed to find out the temperature rise or change

(c) (i) any one from
  
  • magnesium is the most reactive metal used
  
  • the biggest difference in reactivity is between magnesium and copper
    accept ‘magnesium is above the others’
    accept ‘magnesium is more reactive than iron and zinc’

(ii) any one from
  
  • the reactivity is nearly the same
  
  • they are next to each other in the reactivity series
    accept ‘zinc is slightly more reactive than iron’
    ‘zinc is more reactive than iron’ is insufficient

(iii) •

<table>
<thead>
<tr>
<th>mixture</th>
<th>Would there be a rise in temperature?</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminium + sodium chloride</td>
<td>no</td>
</tr>
<tr>
<td>calcium + zinc sulphate</td>
<td>yes</td>
</tr>
<tr>
<td>lead + zinc chloride</td>
<td>no</td>
</tr>
<tr>
<td>magnesium + iron chloride</td>
<td>yes</td>
</tr>
</tbody>
</table>
award one mark for identifying the two reactions that take place
award one mark for identifying the two mixtures of chemicals which do not react

2 (L7) [6]

M2. (a) any one from

- goggles
  accept ‘safety glasses’
  ‘glasses’ is insufficient

- hairband
  accept ‘hair tied back’
  ‘lab coat’ is insufficient
  ‘using tongs’ or ‘a heat-proof mat’ is insufficient

1 (L3)

(b) • 50 seconds

1 (L3)

(c) (i) **both the tick and the matching explanation are required for the mark**

- yes ✓
  - crisp A was the biggest and it burnt for 80 seconds
    accept ‘crisp A burnt for the longest time’
    accept ‘the biggest crisp burnt for 80s’
    ‘crisp A burnt for a long time’ is insufficient
    ‘crisp D burnt for the shortest time’ is insufficient

  or

- no ✓
  - crisp B was the smallest and it burnt for longer than crisp D
    accept ‘the smallest crisp did not burn for the least time’
    accept ‘crisp B did not burn for the shortest time’
    accept ‘Joanne’s test was not fair’
    accept ‘C and D are the same size but burn for different times’

1 (L4)
(ii) any one from

- they were not all the same type or make
  accept ‘different shapes’
  ‘the crisps are different sizes’ is insufficient

- two were crinkled crisps
  accept ‘the crisps were from a different packet’
  ‘the crisps were different’ is insufficient

(d) • false ✓
• false ✓
• cannot tell ✓

if more than one box is ticked in any row, do not award a mark for that row

M3. (a) (i) • distance from the (top of the) balloon to the ceiling

accept ‘distance’ or ‘height to ceiling or roof’

and

time for the balloon to rise to the ceiling or roof

accept ‘time’

both answers are required for the mark
the answers can be in either order
‘height (of ceiling)’ is insufficient as this implies the distance from the floor
‘how high it goes’ is insufficient
‘metres’ is insufficient
‘seconds’ is insufficient
(ii) • divide the distance by the time
\[
\frac{\text{distance}}{\text{time}} = \frac{d}{t}
\]
accept ‘time’ or ‘t’

‘how many metres it travelled per minute or second’ is insufficient
\[
\frac{\text{height}}{\text{time}}
\]
accept ‘time’ if height is given in part (i)

‘m/s’ is insufficient
accept ‘distance over time’
\[
\frac{\text{metres}}{\text{seconds}}
\]
‘seconds’ is insufficient

1 (L7)

(b) (i) any one from

• the negative numbers

• the –20 and/or the –70

1 (L7)

(ii) • all three points plotted correctly as shown below

accept points plotted within ± ½ small square of the correct answer

1 (L6)

• an appropriate line of best fit as shown above

accept a line of best fit consistent with the plotted points

1 (L7)

(iii) • 26 g

accept the x axis intercept ± 1 small square from the line of best fit drawn

1 (L7)
M4. (a) • Zoe ✓

\textit{if more than one box is ticked, award no mark}

1 (L3)

\begin{itemize}
  \item any one from
  \begin{itemize}
    \item \textit{best} needs to be defined
      \begin{itemize}
        \item accept ‘\textit{best} needs to be described’
        \item accept ‘you do not know what \textit{best} means’
      \end{itemize}
    \item \textit{best} is not observable \textbf{or} measurable
    \item \textit{best} is subjective
      \begin{itemize}
        \item accept ‘it is not doable’
        \item accept ‘\textit{best} is an opinion \textbf{or} judgement’
        \item accept ‘\textit{best} is not clear’
      \end{itemize}
  \end{itemize}
\end{itemize}

\begin{itemize}
  \item \textit{any one} from
  \begin{itemize}
    \item use the same area of material each time
    \item use the same volume of water
      \begin{itemize}
        \item accept ‘same \textit{amount} of material’
        \item accept ‘same \textit{size} of rucksack’
        \item accept ‘same \textit{amount} of water’
        \item accept ‘same \textit{liquid}’
        \item accept ‘same \textit{timing}’
        \item accept ‘allow the water to drip through the material for the same \textit{length} of time’
        \item accept ‘keep the temperature the same’
        \item do not accept ‘do it more than once’
      \end{itemize}
  \end{itemize}
\end{itemize}

1 (L3)

(b) (i) any one from

\begin{itemize}
  \item \textit{measuring cylinder}
  \item \textit{stopclock} or \textit{stopwatch}
    \begin{itemize}
      \item accept ‘\textit{measuring beaker}’
      \item accept ‘\textit{clock}’ or ‘\textit{timer}’ or ‘\textit{watch}’
      \item do not accept ‘\textit{cylinder}’ \textbf{or} ‘\textit{measuring tube}’ \textbf{or} ‘\textit{measuring jug}’
    \end{itemize}
\end{itemize}

1 (L3)
(c)  B ✓
if more than one box is ticked, award no mark

- the smallest volume of water passes through the material
  accept 'only 5 cm³ passed through'
  accept 'less water passed through'
  accept 'not as much water gets through'
answers must include or imply a comparison
'5 cm³ passed through' is insufficient
'not much water gets through' is insufficient

1 (L4)

M5.

(a) (i) all five points plotted

if five points are correctly plotted, award two marks
if three or four points are correctly plotted, award one mark

- a straight line of best fit consistent with plotted points
  accept a curve of best fit consistent with plotted points

1 (L5)

(ii)  74g
accept any number from 73 to 75 (inclusive)
award a mark for a number consistent with a drawn extrapolation of the line of best fit and within the range of 72 to 76

1 (L6)
(b) • concentration (of hair dye)
   accept ‘conc’
   ‘hair dye’ is insufficient
   accept ‘strength of hair dye’
   ‘strength’ is insufficient
   accept ‘percentage’
   do not accept ‘force’ or ‘mass’ or ‘weight’

(c) any one from
   • mass needed to break the hair
     accept ‘force’ or ‘weight’
     accept ‘mass’

   • strength of hair
     ‘strength’ is insufficient

(d) • the greater the concentration of hair dye
    the less mass is needed (to break the hair)
    accept the converse
    accept ‘the stronger the hairdye, the weaker it is’
    accept ‘the stronger, the less weight is needed (to break the hair)’
    accept ‘it is a negative correlation’
    references to time are neutral
    ‘the stronger the weaker’ is insufficient
    ‘the hair is weaker when he uses more dye’ is insufficient

(e) • soaking time
    accept ‘time’
    column headings may be reversed
    the unit mark can be awarded only if consistent with the heading

    • minutes or seconds or hours
      accept unambiguous indications of the units e.g. ‘min(s)’ or ‘s’ or ‘sec’ or ‘h’ or ‘hrs’
      ‘m’ is insufficient as it is ambiguous

    • mass (needed to break hair)
      accept ‘strength’ or ‘weight’ or ‘force’

    • grams or g
      accept ‘N’ where ‘force’ is given in place of mass
      do not accept ‘n’ for ‘N’
      accept ‘N’ or ‘g’ for weight
      do not accept ‘g’ if ‘force’ is given
M6. (a)  •  7 days

(b)  •  air temperature and soil moisture ✔

if more than one box is ticked, award no mark

1 (L3)

(c)  any one from

•  he only carried out his experiment at a medium light level
  accept 'he did not try other levels'
  'it was not a fair test' is insufficient

•  he only used one light level

•  he did not change the (amount of) light

1 (L4)

(d)

<table>
<thead>
<tr>
<th>tray</th>
<th>day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
</tr>
</tbody>
</table>

accept any whole number from 6 to 8
accept any whole number from 2 to 8
accept any whole number from 0 to 4

award two marks for all four correct answers
award one mark for any two or three correct answers

2 (L4)

M7. (a)  any one from

•  mass of salt (in the solution)
  accept 'amount or weight of salt'
  'salt' is insufficient

•  concentration

1 (L5)

(b)  (i)  •  point at (10, 33) circled

1 (L5)

(ii)  any one from

•  an incorrect reading
  accept 'she could have read the scale wrongly'

•  a recording error
  accept 'she wrote the wrong result'
  accept 'she marked the wrong point on the graph'
• an error during the investigation
  accept ‘the wrong mass was added’
  accept ‘not enough salt was added’
  accept ‘too much water’
  do not accept ‘too much salt’

1 (L6)

(c) either

- Abi
  both the answer ‘Abi’ and the correct explanation are required for the mark
  need to check accuracy or correct an error or accept ‘to check whether it is right or wrong’ check an anomaly accept ‘to check whether it is right or wrong’ accept ‘she might have done it differently’ accept ‘it’s a freak result’ ‘it is a fair test’ is insufficient

or

- Robert
  you can predict the results from the pattern in the graph accept ‘you can use the graph’ accept ‘you can ignore the point’ accept ‘there is enough evidence’ or both the answer ‘Robert’ and the correct explanation are required for the mark award a mark if both Abi and Robert are ticked if the reason given explains why both could be correct

1 (L6)

(d) • true false cannot tell

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

if all four rows are correct, award two marks
if two or three rows are correct, award one mark
if more than one box is ticked on any row, award no credit for that row

2 (L6)
M8. (a) •

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>45 or 46</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
</tr>
</tbody>
</table>

_all three answers are required for the mark_ 1 (L5)

(b) any one from

• the height for 4 cm is 4 times the height for 2 cm
  accept ‘for 2 cm it went 20 cm but for 4 cm it went 80 cm’
  a mark may be awarded for other correct figures
  accept ‘if I double the distance it goes four times as high’
  ‘when she doubled the distance it did not double the height’
  is insufficient

• the graph is a curve
  accept ‘the graph is not a straight line’

• the height for 2 cm is not twice the height for 1 cm
  accept ‘if it goes from 2 to 3 cm, the height more than doubles’

• the height should have been 40 cm when he pressed it down 4 cm
  accept appropriate arguments for other values 1 (L6)

(c) (i) • some some

_both answers are required for the mark_ 1 (L6)

(ii) • most least

_both answers are required for the mark_
answers must be in the correct order 1 (L6)

(iii) • least least

_both answers are required for the mark_ 1 (L6)
M9. (a) • (37 °C is) body temperature
   accept ‘so the saliva or enzymes would work’
   accept ‘it is a good or optimum temperature for digestion’
   ‘to make it a fair test’ is insufficient
   ‘so they are all the same’ is insufficient

1 (L5)

(b) (i) • the starch is broken down or digested
   ‘there is a reaction between starch and saliva’ is insufficient

1 (L6)

(ii) any one from
   • starch could not pass through the bag
     accept ‘starch could not get through the holes’
     ‘the bag is semi-permeable’ is insufficient
   • starch is too big
     ‘the bag holds it in’ is insufficient

1 (L6)

(c) • for a control ✓
   if more than one box is ticked, award no mark

1 (L6)

(d) (i) • P
   if more than one letter is given, award no mark

1 (L6)

(ii) • R
   if more than one letter is given, award no mark

1 (L6)

(e) • enzymes
   accept ‘amylase’ or ‘carbohydrase’

1 (L6)

(f) any one from
   • sweeter or sugary
     accept ‘sugar’ or ‘sweet’
   • it tastes of sugar (L6)

1

[8]
M10. (a) • a ruler
   accept ‘a metre rule’
   accept ‘a tape measure’
   ‘cm’ is insufficient ‘a measuring stick’ is insufficient
1 (L3)

(b)   (i) • 30
do not accept ‘30 seconds’
1 (L3)

(ii) • A to B: any number from 5 to 15
     accept a range such as ‘5 to 10’
     1 (L4)

     • D to E: any number from 45 to 80
     accept a range such as ‘50 to 60’
     1 (L4)

(c) any one from

• you can measure smaller intervals of time
   accept ‘each section burns for a shorter time’
   accept ‘it is more precise or accurate’
   ‘it is easier to read’ is insufficient

• the lines are closer
   accept ‘the lines are close’
   accept ‘the lines are further apart on candle 1’
   accept ‘the lines are 1 cm apart on candle 1 and 0.5 cm apart on candle 3’
   accept ‘there are more lines or smaller spaces or smaller segments’
   accept ‘more sections or rings’
   ‘the lines are smaller’ is insufficient

1 (L4)
M11. (a)  

(i) any one from

• more fishing boats
  accept ‘more people were fishing’
  accept ‘more fishing’
  accept ‘more boats’
  ‘more being caught’ is insufficient 1 (L5)

(ii) any one from

• overfishing
  accept ‘too many fish were caught’
  ‘lots of fish were caught’ is insufficient
  accept ‘few fish or herring were left in the sea’
  do not accept ‘no herring or fish left’
  do not accept ‘too many boats’

• fish were caught before they could breed

• fish were not allowed time to breed
  accept ‘fish were smaller’
  ‘the herring are too young’ is insufficient
  ‘less being caught’ is insufficient 1 (L5)

(iii) any one from

• to allow numbers to recover or increase
  do not accept ‘they were becoming extinct’

• to allow more herring to breed
  accept ‘so the herring would be old’
  ‘to allow herring to be born’ is insufficient

• to allow more herring to mature
  enough or mature enough to breed
  accept ‘it is the breeding time’
  ‘there were fewer herring left’ is insufficient 1 (L5)

(b)  

(i) any one from

• cod eat sand eels instead of herring
  ‘cod have to eat something else’ is insufficient

• cod eat more sand eels
  ‘cod eat sand eels’ is insufficient

• cod eat capelin instead of herring so there is less food for sand eels
  accept ‘cod would eat more capelin’
  accept ‘cod would eat the sand eels’ food’
  ‘less food for sand eels’ is insufficient as it implies that sand eels eat herring
  ‘because the cod only had two choices’ is insufficient 1 (L6)
(ii) any one from

- there would be more animal plankton
  accept ‘more plankton’
  ‘they will have more to eat or more food’ is insufficient

- fewer cod
  ‘the animal plankton would get bigger’ is insufficient
  ‘less food for cod’ is insufficient

1 (L6) [5]
M12. Markers should read the answers to parts a and b before marking this question. Parts a and b should be marked together.

(a)  
- temperature of the water  
  accept ‘temperature’  
  accept ‘room temperature’  
  do not accept responses that describe rates of heating.

  any one from

- rate of evaporation  
  accept ‘the time for it to evaporate’  
  answers must refer to both time taken and amount of water lost

- time taken for all the water to evaporate  
  accept ‘measure how much water is left after a certain time’  
  ‘time taken’ is insufficient

- volume or mass or amount of water lost in a fixed time

  any one from

- starting volume of water  
  accept ‘the amount of water’  
  accept a specified volume of water  
  ‘same heater’ and ‘same starting measurement’ are insufficient

- shape of container

- same ambient conditions  
  accept ‘room temperature’ if the independent variable is ‘water temperature’

(b) a column or row indicating temperature and a column or row indicating time or volume lost or volume remaining

  accept a column or row indicating ‘rate of evaporation’  
  accept ‘amount lost’ or ‘amount remaining’

  both headings are required for the mark  
  the units of measurement are not necessary for the mark  
  the second column or row should be consistent with the dependent variable identified in part a  
  ignore other columns in the table
M13. (a) (i) the number of turns or coils of wire
   accept ‘the coils’
   accept ‘the turns’

   (ii) any one from
   • the current
   • the length or thickness or material of the wire or coil
     accept ‘the voltage or power’
     accept ‘the wire’
   • the circumference of the coil
   • the size of paper-clips
     accept ‘the paper-clips’; ‘position of the coil on the nail’;
     ‘tightness of the coil’; accept ‘distance between turns’;
     ‘the nail’
     do not accept ‘the number of paper-clips’

   (iii) any one from
   • count the paper-clips picked up
     accept ‘number of paper-clips’; ‘count them’
   • measure their mass
     accept ‘weigh them’; ‘the more clips the stronger
     the magnet’;
     ‘measure the distance at which a magnet will just pick up
     a paper-clip’

   (b) any one from
   • an inaccuracy in results
     accept a description of inaccuracies, such as
     ‘she counted the number of clips wrongly’
   • a problem with the data or results
   • a problem with the method
     accept ‘something wrong with the tests’
     accept ‘she used different sized paper-clips’
     accept ‘the paper-clips were already magnetised’
     accept ‘she did something wrong’
     ‘the test is unfair’ is insufficient
(c) (i) 

![Checkmarks]

*If more than one box is ticked, award no mark*

1 (L6)

(ii) any one from

- with bigger paper-clips she might miss the precise point at which the electromagnet stopped picking up paper-clips
  
  *accept 'she would pick up differences between the number of turns of the coil'*
  
  *accept 'she might not see a change with big paper-clips or she would see a change with smaller paper-clips'*
  
  'it will pick up a few large paper-clips but a lot of small paper-clips' is insufficient

- the smaller paper-clips might help to identify the precise point at which the electromagnet stopped picking up paper-clips
  
  *accept 'it is more precise or more sensitive'*
  
  **Award a mark for a response identifying that greater precision is possible with smaller increments**
  
  'they are smaller' is insufficient

1 (L6) [6]
M14. (a) (i) a number from 8.0 to 8.2 s (inclusive)  

(ii) a number from 34 to 36 m (inclusive) 

(iii) 4 s  

\textit{accept response in the range 3.7–4.3}  

(b) the slope or gradient is constant  

\textit{accept 'it is a straight line'}  

\textbf{do not} accept 'the line is flat'  

\textit{accept 'steady increase'}  

(c) (i) points (0, 0) and (15, 30) joined by a straight line  

\textit{accept points drawn to ± 1 mm}  

(ii) 50  

\[ \frac{\text{'100'} \times 2}{2} \]  

\textit{accept}