READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Answer all questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
1 Fruit juice can be produced by crushing and squeezing fresh fruit. The juice produced in this way is often cloudy.

The enzyme pectinase is used to produce clear fruit juice. This process is called clarification.

Fig. 1.1 shows fruit juice before and after clarification.

A student investigated the effect of pectinase concentration on the clarification of apple juice.

The student was provided with freshly prepared apple juice, water and a 5% pectinase solution.

Step 1 Four test-tubes were labelled P1, P2, P3 and P4.

Step 2 Syringes were used to add the volumes of water and 5% pectinase solution shown in Table 1.1 to each of the test-tubes.

<table>
<thead>
<tr>
<th>test-tube</th>
<th>volume of water / cm³</th>
<th>volume of 5% pectinase solution / cm³</th>
<th>final percentage concentration of pectinase solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>0.00</td>
<td>1.00</td>
<td>5.0</td>
</tr>
<tr>
<td>P2</td>
<td>0.50</td>
<td>0.50</td>
<td>2.5</td>
</tr>
<tr>
<td>P3</td>
<td>0.75</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>1.00</td>
<td>0.00</td>
<td>0.0</td>
</tr>
</tbody>
</table>
(a) Calculate the final concentration of the pectinase solution in test-tube P3.

Show your working and write your answer, to one decimal place, in Table 1.1.

Step 3  5 cm$^3$ of apple juice was added to each of test-tubes P1, P2, P3 and P4.

Step 4  The contents of each test-tube were carefully mixed using a glass rod.

Step 5  A stop-clock was immediately started.

Step 6  After five minutes, the height of the precipitate formed was measured using a ruler, as shown in Fig. 1.2. If no precipitate had formed in the test-tube, it was recorded as '0'.

Care was taken not to shake the test-tubes.

Step 7  After a further five minutes, the student repeated the measurement of the precipitates in the test-tubes.
Fig. 1.3 shows the test-tubes at 0, 5 and 10 minutes.
(b) Prepare a table to record the results.

Measure the height of the precipitate in each test-tube in Fig. 1.3.

Record the measurements in your table.

(c) State a conclusion for the results.

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................................................................................................................................................... [2]

(d) (i) State the variable that was changed (independent variable) in this investigation.

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(ii) State two variables that should have been kept constant in this investigation.

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

2 .............................................................................................................................................. [2]
(iii) Identify one possible error in step 6 and suggest an improvement.

error

improvement

(e) Explain the purpose of test-tube P4.

(f) A student stated the hypothesis:

“Treating fruit juice with pectinase reduces the vitamin C content of the fruit juice”.

Plan an investigation to test this hypothesis.
(g) Fig. 1.4 shows a cross-section of a tomato fruit.

Make a large drawing of the cross-section of tomato fruit.
(h) A student wanted to find out if tomatoes contained starch.

State the result you would expect for a positive test for starch.

.............................................................................................................................................[1]

[Total: 26]
A student investigated the number of petals on the flowers of two species of daisy, species A and species B.

(a) Fig. 2.1 shows one daisy flower of species A.

The actual length of petal XY of the daisy in Fig. 2.1 was measured by the student as 5 mm.

Measure the length of petal XY on Fig. 2.1. Include the units.

length of XY on Fig. 2.1 ........................................

Use the formula to calculate the magnification of the photograph.

\[
magnification = \frac{\text{length of XY on Fig. 2.1}}{\text{actual length of petal XY}}
\]

Show your working.

................................................................. [2]
The student collected 10 flowers from species A and 10 flowers from species B. They counted the number of petals on each flower.

Fig. 2.2 shows some of the daisy flowers of species A.

![Daisy flowers with annotations 9 and 10]

(b) (i) Count the number of petals on flowers 9 and 10 in Fig. 2.2 and record the number of petals in Table 2.1.

<table>
<thead>
<tr>
<th>flower number</th>
<th>species A</th>
<th>species B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

average number of petals 17
(ii) Calculate the average number of petals for species B.

Write your answer in Table 2.1. Give your answer to the nearest whole number.

Space for working.

(iii) Suggest one method that could be used to ensure that the counting of the number of petals is accurate.

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(c) Plot a bar chart on the grid of the average number of petals for species A and species B from Table 2.1.
(d) State two reasons why the student should have repeated the investigation.

1 ................................................................................................................................................
2 ................................................................................................................................................

(e) The student noticed that insects fed on the nectar produced by the flowers.

(i) Describe the test that the student would use to find out if the nectar contains reducing sugars.
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(ii) State one safety precaution that should be taken when carrying out the test for reducing sugars.
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................................................................................................................................................[1]

[Total: 14]