Paper 1 exp skills

Name: ________________________
Class: ________________________
Date: ________________________

Time: 128 minutes
Marks: 126 marks
Comments:
Figure 1 shows a human cheek cell viewed under a light microscope.

(a) Label the nucleus and cell membrane on Figure 1.

(b) Cheek cells are a type of body cell. Body cells grow through cell division. What is the name of this type of cell division?
Tick one box.

- Differentiation
- Mitosis
- Specialisation

(c) Ribosomes and mitochondria are not shown in Figure 1. What type of microscope is needed to see ribosomes and mitochondria?
(d) What is the advantage of using the type of microscope you named in part (c)?

Tick one box.

Cheaper

Higher magnification

Lower resolution

(e) The cheek cell in Figure 2 is magnified 250 times.

The width of the cell is shown by the line D to E.

Figure 2

Calculate the width of the cheek cell in micrometres (µm).

Complete the following steps.

Measure the width of the cell using a ruler _____________________ mm

Use the equation to work out the real width of the cell in mm:

\[
\text{real size} = \frac{\text{image size}}{\text{magnification}}
\]

____________________ mm

Convert mm to µm _____________________ µm

(3)
(f) A red blood cell is 8 µm in diameter.

A bacterial cell is 40 times smaller.

Calculate the diameter of the bacterial cell.

Tick one box.

0.02 µm
0.2 µm
2.0 µm
20.0 µm

The diagram below shows the human digestive system.

(a) Label the stomach and pancreas on the diagram.
(b) Many people suffer from stomach ulcers caused by a species of bacteria called *Helicobacter pylori*.

The stomach is lined with a protective lining of mucus.

*Helicobacter pylori* are acid-tolerant bacteria which can damage this mucus lining.

Suggest how an infection with *Helicobacter pylori* might result in a stomach ulcer developing.

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(2)

(c) *Helicobacter pylori* can also cause stomach cancer.

Describe how a person infected with *Helicobacter pylori* could also develop liver cancer.

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(3)

(d) Gluten is a form of protein found in some grains.

Describe the test you would use to find out if protein is present in food.

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(2)
(e) Coeliac disease is a disease of the digestive system.

It damages the lining of the small intestine when foods that contain gluten are eaten.

When people with coeliac disease eat foods that contain gluten:
1. their immune system forms antibodies to gluten
2. these antibodies attack the lining of the small intestine
3. this causes inflammation in the intestines and damages the villi.

Symptoms of coeliac disease include poor growth.

Suggest why a person with coeliac disease might have this symptom.

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(Total 12 marks)

Plants transport water and mineral ions from the roots to the leaves.

(a) Plants move mineral ions:
• from a low concentration in the soil
• to a high concentration in the root cells.

What process do plants use to move these minerals ions into root cells?

Tick one box.

Active transport

Diffusion

Evaporation

Osmosis

(Total 1 marks)
(b) Describe how water moves from roots to the leaves.

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(2)

(c) Plants lose water through the stomata in the leaves.

The epidermis can be peeled from a leaf.

The stomata can be seen using a light microscope.

The table below shows the data a student collected from five areas on one leaf.

<table>
<thead>
<tr>
<th>Leaf area</th>
<th>Number of stomata</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper surface</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>2</td>
</tr>
</tbody>
</table>

Describe how the student might have collected the data.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(3)
(d) What is the median number of stomata on the upper surface of the leaf?

__________________________________________________________________________________________

(1)

(e) Calculate the value of $X$ in the table.
Give your answer to 2 significant figures.

__________________________________________________________________________________________

Mean number of stomata on lower surface of leaf = _____

(2)

(f) The plant used in this investigation has very few stomata on the upper surface of the leaf.

Explain why this is an advantage to the plant.

__________________________________________________________________________________________

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(2)

(Total 11 marks)

The lugworm lives in a U-shaped burrow in the sand on the seashore.

The diagram below shows a lugworm in its burrow.
(a) Some scientists investigated the effect of different salt concentrations on lugworms.

The scientists:

• collected 50 lugworms from the seashore
• separated them into five groups of 10 lugworms
• weighed each group of 10 lugworms
• placed each group into a different concentration of salt solution and left them for 8 hours
• took each lugworm out of the solution and placed it on blotting paper for 30 seconds
• re-weighed each group of 10 lugworms.

(i) Why did the scientists use groups of 10 lugworms and not just 1 lugworm at each concentration?

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(1)

(ii) Suggest why the scientists placed each lugworm on blotting paper for 30 seconds before they reweighed the groups of lugworms.

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(1)

(iii) How might the method of blotting have caused errors in the results?

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(1)

(iv) Suggest one improvement the scientists could make to their investigation.

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(1)
The table below shows the scientists' results.

<table>
<thead>
<tr>
<th>Concentration of salt in arbitrary units</th>
<th>Mass of 10 lugworms at start in grams</th>
<th>Mass of 10 lugworms after 8 hours in grams</th>
<th>Change in mass in grams</th>
<th>Percentage (%) change in mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>41.2</td>
<td>61.8</td>
<td>+20.6</td>
<td>+50</td>
</tr>
<tr>
<td>2.0</td>
<td>37.5</td>
<td>45.0</td>
<td>+7.5</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>55.0</td>
<td>56.1</td>
<td>+1.1</td>
<td>+2</td>
</tr>
<tr>
<td>4.0</td>
<td>46.2</td>
<td>22.2</td>
<td>-24.0</td>
<td>-52</td>
</tr>
<tr>
<td>5.0</td>
<td>45.3</td>
<td>22.6</td>
<td>-22.7</td>
<td>-50</td>
</tr>
</tbody>
</table>

(i) The scientists calculated the percentage change in mass at each salt concentration. Why is the percentage change in mass more useful than just the change in mass in grams? Use information from the table in your answer.

(ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

Percentage change in mass = ______________________ %

(2)
(c)  (i)  On the graph paper below, draw a graph to show the scientists’ results:

- plot the **percentage** change in mass
- label the horizontal axis
- draw a line of best fit.

(ii) The scientists thought one of their results was anomalous. Draw a ring around the anomalous result on your graph.

(iii) Suggest what might have happened to cause this anomalous result.

________________________________________________________________________

________________________________________________________________________

(1)
(d) (i) What do you think is the concentration of salts in the lugworm’s natural environment?

Use information from your graph to give the reason for your answer.

Concentration = ______________________ %

Reason _______________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
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_________________________________________________________________

(2)

(ii) The mass of the lugworms decreased in the salt solution with a concentration of 5.0 arbitrary units.

Explain what caused this.
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_________________________________________________________________
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(3)

(Total 19 marks)

All living cells respire.

(a) Respiration transfers energy from glucose for muscle contraction.

Describe how glucose from the small intestine is moved to a muscle cell.
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

(2)
(b) The diagram below shows an experiment to investigate **anaerobic** respiration in yeast cells.

What is the purpose of the liquid paraffin in Tube A?

Tick **one** box.

- To prevent evaporation
- To stop air getting in
- To stop the temperature going up
- To stop water getting in

(1)
(c) The indicator solution in Tube B shows changes in the concentration of carbon dioxide (CO$_2$).

The indicator is:

- **blue** when the concentration of CO$_2$ is very low
- **green** when the concentration of CO$_2$ is low
- **yellow** when the concentration of CO$_2$ is high.

What colour would you expect the indicator to be in Tube B during maximum rate of anaerobic respiration?

Tick one box.

- Blue
- Green
- Yellow

(d) Suggest how the experiment could be changed to give a reproducible way to measure the rate of the reaction.

Include any apparatus you would use.

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___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(1)

(2)
(e) Compare anaerobic respiration in a yeast cell with anaerobic respiration in a muscle cell.

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(3)
(Total 9 marks)
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

How would you investigate the effect of **light intensity** on the rate of photosynthesis?

The image below shows some of the apparatus you might use.

You should include details of:

- how you would set up the apparatus and the materials you would use
- the measurements you would make
- how you could make this a fair test.
Anaerobic respiration happens in muscle cells and yeast cells. The equation describes anaerobic respiration in muscle cells.

\[
\text{glucose} \rightarrow \text{lactic acid}
\]

(a) How can you tell from the equation that this process is anaerobic?

(b) Exercise cannot be sustained when anaerobic respiration takes place in muscle cells. Explain why.
(c) The diagram below shows an experiment to investigate **anaerobic** respiration in yeast cells.

![Diagram of yeast cells in sugar solution with liquid paraffin, gas bubbles, Limewater, and a connection to Tube B.]

What gas will bubble into Tube B?

Tick **one** box.

- Carbon dioxide
- Nitrogen
- Oxygen
- Water vapour

(1)

(d) Describe how you could use tube B to measure the rate of the reaction in tube A.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)
Anaerobic respiration in yeast is also called fermentation.

Fermentation produces ethanol.

Give one use of fermentation in the food industry.

___________________________________________________________________

(1)
(Total 7 marks)
A potometer is a piece of apparatus that can be used to measure water uptake by a leafy shoot.

**Figure 1** shows a potometer.

![Figure 1](Image)

Some students used a potometer like the one shown in **Figure 1**.

- They measured the water taken up by a shoot in normal conditions in a classroom.
- As the water was taken up by the shoot, the level of water in the capillary tube went down.
- The students recorded the level of the water in the capillary tube at 2-minute intervals for 10 minutes.

**Table 1** shows the students’ results.

<table>
<thead>
<tr>
<th>Time in minutes</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of water (on scale) in capillary tube in mm</td>
<td>2.5</td>
<td>3.6</td>
<td>4.4</td>
<td>5.4</td>
<td>6.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>
The area of the cross section of the capillary tube was 0.8 mm².

(a) (i) Complete the following calculation to find the volume of water taken up by the shoot in mm³ per minute.

Distance water moved along the scale in 10 minutes = ______ mm

Volume of water taken up by the shoot in 10 minutes = ______ mm³

Therefore, volume of water taken up by the shoot in 1 minute = ______ mm³

(ii) The students repeated the investigation but this time placed the potometer next to a fan blowing air over the leafy shoot.

Suggest how the results would be different. Give a reason for your answer.

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______________________________________________________________________________

(2)
The students repeated the investigation at different temperatures. The results are shown in Table 2.

<table>
<thead>
<tr>
<th>Temperature in °C</th>
<th>Rate of water uptake in mm³ per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0.4</td>
</tr>
<tr>
<td>20</td>
<td>1.0</td>
</tr>
<tr>
<td>25</td>
<td>2.1</td>
</tr>
<tr>
<td>30</td>
<td>3.2</td>
</tr>
<tr>
<td>35</td>
<td>4.0</td>
</tr>
<tr>
<td>40</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Plot the data from Table 2 on the graph paper in Figure 2. Choose suitable scales, label both axes and draw a line of best fit.
(c) What would happen to the leaves if the potometer was left for a longer time at 40 °C?

Explain your answer.

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(3)
(Total 13 marks)
The image below shows some cells on the lower surface of a leaf.

(a) What are the cells labelled X called?

Draw a ring around the correct answer.

- guard cells
- palisade cells
- mesophyll cells

(b) Water loss by evaporation from leaves is called transpiration.

A student set up an experiment to investigate water loss from leaves.

The student:

- took two leaves, A and B, from a plant
- put Vaseline (grease) on both sides of Leaf B; did nothing to Leaf A
- wrote down the mass of each leaf
- attached the leaves onto a string as shown in the diagram below.
Leaf A
(no treatment)

Leaf B
(both surfaces covered in Vaseline)

- left the leaves for 48 hours
- wrote down the mass of each leaf again
- calculated the percentage (%) change in mass for each leaf.

(i) Give one variable that the student controlled in this investigation.
______________________________________________________________________________
______________________________________________________________________________

(ii) The mass of Leaf A was 1.60 g at the start of the investigation. After 48 hours it was 1.28 g.

Calculate the % decrease in mass over 48 hours.
______________________________________________________________________________
______________________________________________________________________________

% decrease = __________________

(c) Vaseline blocks the stomata.

The % change in mass of Leaf B was less than Leaf A after 48 hours. Explain why.
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
(d) Give **three** environmental conditions that would increase transpiration.

1. _________________________________________________________________
2. _________________________________________________________________
3. _________________________________________________________________

(Total 8 marks)

Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

• put a glass tube containing boiled egg white into a test tube
• added a solution containing pepsin at pH 7
• set up six more tubes with solutions of pepsin at different pH values
• left the test tubes for 24 hours at room temperature.

The image below shows one of the test tubes, at the start and at the end of the 24 hours.

(a) (i) Name the product of protein digestion.

____________________________________________________________________

(1)
(ii) What type of enzyme digests protein?

Tick (✓) one box.

- amylase
- lipase
- protease

(b) The egg white in each tube was 50 mm long at the start of the investigation. The table below shows the students’ results.

<table>
<thead>
<tr>
<th>pH</th>
<th>Length in mm of boiled egg white after 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>50</td>
</tr>
</tbody>
</table>

(i) At which pH did the pepsin work best?

pH _______________________

(1)
(ii) The answer you gave in part (b)(i) may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

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________________________________________________________________________
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________________________________________________________________________

(2)

(iii) There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

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________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(2)

(c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

________________________________________________________________________

(1)

(Total 8 marks)
Biological detergents contain protease enzymes.

(a) The drawings show some apparatus and materials.
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawings to find the best temperature for removing stains from clothing.

You should include how you would make the investigation a fair test.

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(b) In a similar investigation a student investigated the effect of pH on the time taken to remove a stain from pieces of cloth.

The table shows the student’s results.

<table>
<thead>
<tr>
<th>pH of detergent solution</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time taken to remove stain in minutes</td>
<td>20</td>
<td>19</td>
<td>17</td>
<td>14</td>
<td>10</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>
(i) On the graph paper below draw a graph to show the student’s results.
  • Add a suitable scale and label to the y axis.
  • Plot the student’s results.
  • Draw a line of best fit.

(ii) Which is the best pH for using the detergent?
  pH _____________________________

(c) Scientists investigated the stability of a protease enzyme. The protease enzyme was 
extracted from plants.

The scientists:
• pre-incubated samples of the enzyme at various temperatures for 30 minutes
• put each sample on ice for a further 10 minutes
• measured the percentage (%) remaining activity of the enzyme in each sample. 
  This was done by incubating each sample with protein at 37 °C for 6 hours.
The scientists recommended that the enzyme could be used in detergents at a temperature of 60 °C.

Suggest why the scientists recommended a temperature of 60 °C. Use information from the graph and your own scientific knowledge in your answer.

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(3)
(Total 14 marks)
Infections by antibiotic resistant bacteria cause many deaths.

The bar chart below shows information about the number of deaths per year in England from *Methicillin-resistant Staphylococcus aureus* (MRSA) and from *Clostridium difficile* (C. difficile) over 4 years.

(a) (i) Describe the trend for deaths caused by *C. difficile*.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(ii) Suggest a reason for the trend you have described in part (a)(i).

Explain your answer.

________________________________________________________________________

________________________________________________________________________

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________________________________________________________________________

(2)
(iii) Calculate the percentage change in deaths caused by MRSA from 2009 to 2010.

Percentage change in deaths caused by MRSA = _______________ %

(iv) Numbers have not yet been published for 2011.

When the numbers are published, scientists do not expect to see such a large percentage change from 2010 to 2011 as the one you have calculated for 2009 to 2010.

Suggest one reason why.

(b) Before 2007 there was a rapid increase in the number of deaths caused by MRSA.

Describe how the overuse of the antibiotic methicillin led to this increase.
Mark schemes

(a) nucleus labelled correctly
   1
   cell membrane labelled correctly
   1

(b) mitosis
   1

(c) electron (microscope)
   1

(d) higher magnification
   1

(e) 45 (mm)
   1

   \[
   \text{allow } \frac{45}{250} \text{ or } 0.18 \text{ (mm)}
   \]

   \[
   \text{allow } 180 \text{ (µm)}
   \]
   1

   \[
   \text{allow } 180 \text{ (µm)} \text{ with no working shown for 3 marks}
   \]

(f) 0.2 µm
   1

(a) stomach and pancreas correctly labelled
   1

(b) bacteria not killed (by stomach acid / HCl) and so they damage mucus lining
   1

   so acid / HCl damages stomach tissue / causes an ulcer
   allow bacteria infect stomach tissue

(c) if the cancer is malignant
   1

   (cancer) cells can spread to other organs
   via the blood forming a secondary tumour
   do not award marking points 2 or 3 without marking point 1

(d) add Biuret reagent to food sample
   allow sodium / potassium hydroxide (solution) + copper sulfate(solution)
   1
Mauve/purple colour shows protein present

e) Damaged villi reduce surface area for absorption (of food molecules)

(therefore) fewer amino acids and glucose absorbed

With less glucose transfer of energy from respiration is reduced

And fewer amino acids available to build new proteins

(a) Active transport

(b) By transpiration stream/pull

In xylem

c) Any three in the correct order from:
   • Mount epidermis on a slide
   • Count stomata in one area
   • Repeat in four more areas
   • Repeat method on other surface of leaf
   • Calculate mean

   Allow nail varnish film

(d) 1

Allow numbers written out in a line with middle number circled

(e) \((44 + 41 + 40 + 42 + 39) / 5 = 41.2\)

   41

   Allow 41 with no working shown for 2 marks

   Allow 41.2 for 1 mark

(f) Less water lost

So it does not wilt
(a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies

or

one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible

(ii) remove solution / liquid (on outside of worm)
allow ‘water’

(iii) variable amounts removed from each worm
ignore reference to length of timing

(iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals
allow reference to improve blotting technique eg blot before / blot more thoroughly

(b) (i) different (starting) masses / sizes / weights (at different concentrations)
allows comparisons / shows pattern / shows trend

(ii) (+)20
correct answer = 2 marks, with or without working
or
\[
\frac{7.5 \times 100}{37.5} / \frac{7.5}{37.5} / \frac{(45.0 - 1) \times 100}{37.5}
\]
for 1 mark

(c) (i) graph:
points correct
allow ± 1 mm
−1 mark per error
allow ecf from part b(ii)

label on x-axis including units – ie Concentration of salt in arbitrary units
line of best fit = smooth curve / ruled straight line
    anomaly (4.0, –52) either plotted and ignored re. line
    or not plotted
    do not allow point to point
    allow best fit for ecf from 2bii

(ii) on graph:
    ring drawn around point at (4.0, –52)
    allow (5.0, –50) if cand. line indicates this

(iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% /
    different length of time in solutions / ref to error in blotting / balance not zeroed /
    error in weighing
    allow some lugworms died
    allow error in calculation

(d) (i) 2.9 to 3.0 / correct for candidate’s graph ± 0.1
    value of no change in mass / worms in equilibrium with soln / described
    allow small(est) mass change

(ii) water loss
    by osmosis / diffusion
    from dilute region in the worm to more concentrated solution outside
    allow correct description in terms of high to low water concentration
    / high to low water potential
    salt solution is hypertonic
    concentration unqualified = salt concentration

(a) glucose is absorbed by diffusion into the bloodstream
    then blood delivers glucose to muscles in capillaries

(b) to stop air getting in

(c) yellow
(d) collect the CO$_2$ / gas with a measuring cylinder / gas syringe (volume collected) in a certain time using a timer / watch

(e) yeast produces ethanol but muscles produce lactic acid

*marks can be awarded from correct word or balanced symbol equations*

yeast produces CO$_2$ but muscles do not

*answers must be comparative*

both release small amounts of energy

*ignore both occur without oxygen*
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a ‘best-fit’ approach to the marking.

**Level 3 (5–6 marks):**  
A description of how the apparatus is used to measure the rate of photosynthesis at different light intensities is given.

For full marks reference must be made to a control variable or repeats.

**Level 2 (3–4 marks):**  
A description of how the apparatus is set up and a description of how photosynthesis can be measured. or a description of how light intensity is varied or a control variable or any other relevant point.

**Level 1 (1–2 marks):**  
A partial description of how the apparatus is set up or a description of how light is supplied or a simple description of how photosynthesis can be measured. or a control variable.

**0 marks:**  
No relevant content.

**Examples of the points made in the response:**
- apparatus set up:  
  – weed in water in beaker  
  – light shining on beaker  
- method of varying the light intensity—eg changing distance of lamp from plant  
- method of controlling other variables  
  – use same pond weed or same length of pond weed  
  – temperature: water bath or heat screen  
  – CO₂  
- leave sufficient time at each new light intensity before measurements taken  
- method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas and measuring volume in a syringe  
- measuring rate of photosynthesis by counting bubbles for set period of time  
- repetitions

**Extra information:**

*allow information in the form of a diagram*
(a) no oxygen (is used)
(b) muscles become fatigued / stop contracting
   because not enough energy is transferred
(c) carbon dioxide
(d) count the bubbles
   or
   measure volume of gas
   in a given time
(e) brewing / bread making
   allow other suitable use of fermentation in food industry

8
(a) (i) 5.0
   
   (5 \times 0.8) or 4
   allow ecf from distance
   0.4
   allow ecf from 10-min volume
   (ii) increased (rate of uptake)
       more transpiration / evaporation
(b) correct scales
   allow reversed axes
   correctly labelled axes with units
   correct points
   one plot error = max 1 mark
   curved line of best fit
   allow correct straight line
(c) leaves wilt

because plants lose too much water (by evaporation) through the stomata
or
because cells become plamolysed
or
stomata close
controlled by guard cells
to prevent wilting

(a) guard cells

(b) (i) any one from:

- species / plant
- length of time
  
  *ignore temperature and size of leaves*

(ii) 20

*correct answer = 2 marks*

accept $1.6 - 1.28 \times 100$

or $0.32 \times 100$

*for 1 mark*

(c) less water loss / transpiration / evaporation

(d) hot

*ignore bright / sunny conditions*

dry / low humidity

wind(y)

(a) (i) amino acid(s)

*accept peptide(s)*

*do not allow polypeptide(s)*
(ii) protease

(b) (i) 2

(ii) repeat

   do not allow other enzyme / substrate

   using smaller pH intervals between pH1 and pH3
   allow smaller intervals on both sides of / around pH2
   allow smaller intervals on both sides of / around answer to (b)(i)

(iii) enzyme / pepsin denatured / shape changed

   do not allow enzyme killed
   allow enzyme ‘destroyed’

   enzyme / pepsin no longer fits (substrate)
   allow enzyme / pepsin does not work

(c) hydrochloric (acid)

   allow phonetic spelling
   accept HCl
   allow HCL
   ignore hcl

   do not allow incorrect formula – e.g. H2Cl / HCl₂

   [8]
(a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a ‘best − fit’ approach to the marking.

0 marks
No relevant content.

Level 1 (1 − 2 marks)
The method described is weak and could not be used to collect valid results however does show some understanding of the sequence of an investigation.

Level 2 (3 − 4 marks)
The method described could be followed and would enable some results to be collected but lacks detail.

Level 3 (5 − 6 marks)
The method described could be easily followed and would enable valid results to be collected.

examples of biology points made in the response:

• (use of measuring cylinder to) measure equal volumes of detergent solution
• (use of dropping bottle to) apply same number of drops / amount of stain to each piece of cloth
• include stainless cloth as control
• use of forceps to transfer cloths
• use of test tubes as containers for detergent solution + stained cloth
• use water bath to provide a range of temperatures
• cloths left in detergent solution at each temperature
• for same length of time or measure time taken to remove stain
• repetition
• assessing the stain removal

(b) (i) \( y \) axis: labelled ‘Time (taken to remove stain in) minutes’ plus suitable scale

\textit{data spread greater than half of grid}

points or bars plotted correctly to within ± 1 mm

\textit{deduct 1 mark for each incorrect plot up to a maximum of 2}

one suitable line of best fit drawn on graph

\textit{not feathery}

\textit{not extrapolated to (0,0)}

\textit{not point to point as on this occasion it is inappropriate}

(ii) \( 6 \pm 0.1 \)

\textit{accept ecf from student graph}
(c) activity of enzyme still very high / 84% / over 80%
or
only lost 15% / 16% activity
    allow above 60 °C marked decrease in activity
    allow 85%

any two from:

• rate of reaction high at 60 °C / higher than at lower temperatures
    allow in terms of reaction kinetics / collisions
• higher temperatures would increase (energy) costs
  or
  might damage cloth
  ignore enzyme denaturation
• higher temperatures / 60 °C is better (than lower temperatures) to remove other
  stains / named stains
  or
  better for killing bacteria / infection control
    eg grease

12 (a)  (i) decrease

rate of decrease slows

(iii) any one from:
  • more use of disinfectant
    allow any reasonable increase in hygiene or sterilisation precautions
  • more use of hand washing
  • more careful / more often cleaning of patient facilities
  • raised awareness / education about hygiene

Explanation:
stops / reduces the bacteria being transferred / spreading

(iii) 800 – 500 / 800 × 100 =

37.5 (%)
correct answer with or without working gains 2 marks
(iv) any one from:

- numbers quite low now so hard to reduce further
- was a big campaign / much publicity (in 2009) so more people already doing it
- hygiene / cleaning now good so hard to improve
- hospitals short of money so less staff to clean

(b) mutation occurred giving resistance (to methicillin)

*do not accept overuse caused mutation*

resistant bacteria not able to be treated / not killed

these bacteria multiplied / reproduced / spread quickly