<table>
<thead>
<tr>
<th>Homework Exercise</th>
<th>Questions Due Date</th>
<th>On Time?</th>
<th>Corrections Made?</th>
<th>Comments</th>
</tr>
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</tbody>
</table>
Homework Exercise 1: Ecosystems

1. The grid contains some terms related to the biosphere.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>community</td>
<td>competition</td>
<td>ecosystem</td>
<td>food supply</td>
</tr>
<tr>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td>habitat</td>
<td>light intensity</td>
<td>population</td>
<td>predation</td>
</tr>
</tbody>
</table>

Use letters from the grid to identify the correct term for each of the following:

(i) the interaction between organisms which use the same resources; [ ]
(ii) all the organisms living in a particular area. [ ]

2. To investigate the effect of competition on the growth of cress seeds, five Petri dishes, labelled A–E, were set up and left for six days. Each dish contained a layer of moist cotton wool with different numbers of cress seeds sown evenly across its surface.

Dish A is shown in the diagram.

The results are shown in the table.

<table>
<thead>
<tr>
<th>Dish</th>
<th>Number of seeds sown</th>
<th>Number of seedlings surviving after six days</th>
<th>Percentage of seedlings surviving after six days</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td></td>
<td>95</td>
</tr>
<tr>
<td>D</td>
<td>40</td>
<td>34</td>
<td>85</td>
</tr>
<tr>
<td>E</td>
<td>80</td>
<td>60</td>
<td>75</td>
</tr>
</tbody>
</table>
(a) (i) Complete the table by calculating the number of seedlings surviving in Dish C.

Space for calculation

(ii) Describe the relationship between the number of seeds sown and the percentage of seedlings surviving after six days.

(iii) Explain why the type of competition shown in this investigation is described as being intraspecific.

(b) The diagram represents positions of organisms in a food chain.

Tick one of the boxes to show the position cress would occupy in the food chain.

(c) Name one resource, other than water, for which plants may be in competition.
3.

The diagram shows part of a food web from a forest.

![Food Web Diagram](image)

The numbers of dormice and owls may be affected if the chaffinches were removed from the food web.

(i) **Underline one** answer in the brackets and give an explanation.

The dormouse population would \( \{ \text{increase} \quad \text{decrease} \quad \text{stay the same} \} \).

Explaination ________________________________

______________________________ 1

(ii) **Underline one** answer in the brackets and give an explanation.

The owl population would \( \{ \text{increase} \quad \text{decrease} \quad \text{stay the same} \} \).

Explaination ________________________________

______________________________ 1
The diagram below shows part of an Antarctic food web.

(iii) Select a food chain from the web which is made up of four stages.

_________________ → __________________ → __________________ → _______________

4. The diagram below shows part of an Antarctic food web.

a. Explain why a decrease in sperm whale numbers may lead to an increase in seal numbers.

__________________________________________________________________________
__________________________________________________________________________ 1

b. Identify a herbivore from this food web.

________________________ ___________________________ 1

c. Krill is an omnivore in this food web. Explain what is meant by the term omnivore.

__________________________________________________________________________ 1

d. Name a predator and its prey from this food web.

_____________________________________________ 1
5. The diagram below represents a food chain in a garden.

![Food chain diagram]

a. What term is used to describe the greenfly?

b. Many ladybirds were seen over the summer in the garden. They are able to interbreed and produce fertile offspring.

What can be concluded about the ladybirds from this information?

6. Which word equation best represents the definition of an ecosystem?

- A ecosystem = habitat + population
- B ecosystem = habitat + community
- C ecosystem = population + community
- D ecosystem = community + biodiversity

7. A rabbit feeds on grass, is eaten by foxes and is a habitat for fleas. The statement describes the rabbit’s

- A ecosystem
- B community
- C niche
- D prey

8. In which of the following would competition not occur

- A rabbits grazing in a field
- B owls and foxes hunting for mice
- C daisies and dandelions growing in a lawn
- D algae and fish in a loch
9.

The Cichlid fish below are all found in Lake Malawi in Africa.

a. Using the information shown, identify the feature which enables the fish to have different diets.

b. What advantage does each Cichlid species gain by being a specialised feeder?

c. State the term which describes the role that an organism, such as the Cichlid, plays within its community.
Homework Exercise 2: Distribution of Organisms

1.

A grass area is used as a shortcut by the pupils of a school. An investigation was carried out on the effect this has on the distribution of three types of plants. The diagram below shows the position of five quadrats.

The number of plants found in each quadrat is shown in the table below.

<table>
<thead>
<tr>
<th>Quadrat number</th>
<th>Number of plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daisies</td>
</tr>
<tr>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
</tr>
</tbody>
</table>

(a) Calculate the average number of buttercups found per quadrat.

*Space for calculation*
(b) Use information from the table to describe the effect of using the shortcut on the distribution of daisies and of plantains.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Feature of synovial fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viscosity</td>
</tr>
<tr>
<td>Normal</td>
<td>high</td>
</tr>
<tr>
<td>Inflammation</td>
<td>low</td>
</tr>
<tr>
<td>Infection</td>
<td>low</td>
</tr>
<tr>
<td>Blood leakage</td>
<td>intermediate</td>
</tr>
</tbody>
</table>

(c) The investigation was repeated several times at different points across the shortcut. Give a reason for this.

The table below describes the features of the fluid which lead to the diagnosis of several joint abnormalities.

- Fluid pink .................................................. Blood leakage
- Fluid not pink ............................................. go to 2

1. Low viscosity ........................................
2. High viscosity ........................................
3. .................................................. Infection

Use the information from the table to complete the paired statement key to identify the diagnoses.

2
Levels of air pollution can be estimated by the presence or absence of organisms called lichens.

<table>
<thead>
<tr>
<th>Air pollution level</th>
<th>Most common type of lichen present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Shrubby</td>
</tr>
<tr>
<td>Medium</td>
<td>Leafy</td>
</tr>
<tr>
<td>High</td>
<td>Crusty</td>
</tr>
</tbody>
</table>

Environmental scientists carried out a study on lichen species at four different sites and obtained the results shown in the table below.

<table>
<thead>
<tr>
<th>Site</th>
<th>Shrubby</th>
<th>Leafy</th>
<th>Crusty</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>14</td>
<td>2</td>
</tr>
</tbody>
</table>

(a)  (i) Site A had the highest levels of air pollution.
Using information from both tables, describe the evidence supporting this statement.

(ii) Calculate the average number of leafy lichen species present at the four sites.

Space for calculation

(b) State the name given to species, such as lichen, which are used to estimate levels of pollution.
4. The following paired statement key can be used to identify invertebrate groups.

1. Six legs.............................................. Hexapoda
   More than six legs.............................. go to 2

2. 8 legs............................................... go to 3
   More than 8 legs............................... go to 4

3. Curved sting................................. Dromopoda
   No curved sting......................... Arachnida

4. 1 pair of legs per body segment........ Chilopoda
   2 pairs of legs per body segment .... Diplopoda

Use the key to identify the invertebrate group to which the following organism belongs.

- [ ] A Dromopoda
- [ ] B Arachnida
- [ ] C Chilopoda
- [ ] D Diplopoda

5. Which of the following statements is true of predation?

- [ ] A It is an abiotic factor and causes a decrease in prey numbers.
- [ ] B It is an abiotic factor and causes an increase in prey numbers.
- [ ] C It is a biotic factor and causes a decrease in prey numbers.
- [ ] D It is a biotic factor and causes an increase in prey numbers.
Sampling techniques can be used to estimate the abundance of plants and animals.

(a) In an investigation into ground-living animals in a woodland, a group of students collected and counted the animals they found.

(i) Name a sampling technique which could be used to collect the ground-living animals.

(ii) The students sorted the animals into male and female, counted them and recorded the results in a bar graph.

![Bar Graph]

Key
- Female
- Male

<table>
<thead>
<tr>
<th>Ground-living animals</th>
<th>Number of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodlice</td>
<td></td>
</tr>
<tr>
<td>Springtail</td>
<td></td>
</tr>
<tr>
<td>Beetle</td>
<td></td>
</tr>
<tr>
<td>Centipede</td>
<td></td>
</tr>
</tbody>
</table>
1 Identify the animal which had the greatest overall abundance. 1

2 The students concluded that males were always more abundant than females.
Identify the animal for which this is not true. 1

(iii) It was decided that the samples were not fully representative of the area.
Suggest how the investigation could be improved. 1

(b) The distribution of organisms may be affected by abiotic factors.
The table shows the results of a study into the effect of soil moisture levels on the distribution of three species of plant.

<table>
<thead>
<tr>
<th>Sample site</th>
<th>Soil moisture (units)</th>
<th>Species E</th>
<th>Species F</th>
<th>Species G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.2</td>
<td>11</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>23.4</td>
<td>13</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>22.1</td>
<td>12</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>24.5</td>
<td>15</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>26.6</td>
<td>18</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>28.4</td>
<td>19</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>
7. The following list gives some examples of abiotic and biotic factors which can affect the biodiversity and distribution of organisms.

- temperature
- disease
- grazing by limpets
- light intensity
- moisture
- pH
- predation
- food availability

Circle all the biotic factors shown.

8. An investigation was carried out into the effect of light intensity on the distribution of plant species. At eight different measurement points in a garden, the average light intensity was measured and the percentage ground cover of the plant was recorded.

The results are shown below.
a. What is the light intensity in the garden where the ground cover of the plant was 100%?

b. What was the percentage ground cover of the plant when the light intensity was 750 lux?

c. What is the relationship between light intensity and percentage ground cover of the plant?

   ________________________________________________________________________
   ________________________________________________________________________

   1

d. Explain how light intensity affects the distribution of the plants in the garden.

   ________________________________________________________________________
   ________________________________________________________________________

   1

9. During a woodland survey, a group of students measured some abiotic factors. Readings they took included the temperature of the soil and the air.

   Name one abiotic factor, other than temperature, which they could have measured in the woodland and describe the method of measuring this factor.

   ________________________________________________________________________
   ________________________________________________________________________
   ________________________________________________________________________

   2
Homework Exercise 3: Photosynthesis

1.

(a) The investigation below was set up to show the effect of light intensity on the rate of photosynthesis in pond weed. The rate was measured by counting the number of gas bubbles released per minute.

(i) If the glass sheet was removed what factor, other than light intensity, might affect the rate of photosynthesis?

(ii) Suggest a way in which the light intensity could be altered.

(iii) What raw material needed for photosynthesis is not shown in the diagram?
(iv) Six groups of pupils carried out the investigation. The averages of their results are shown in the table.

<table>
<thead>
<tr>
<th>Light intensity (units)</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average rate of photosynthesis (bubbles/minute)</td>
<td>4</td>
<td>9</td>
<td>12</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

1 From the results, describe the effect of increasing light intensity on the rate of photosynthesis.

________________________________________________________________________________________

2 What is the advantage of having six groups carry out the investigation?

________________________________________________________________________________________

(b) Complete the word equation for photosynthesis.

<table>
<thead>
<tr>
<th>raw materials</th>
<th>light energy</th>
<th>products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2

(c) One of the products of photosynthesis may be converted into a storage carbohydrate in the plant. Name this storage carbohydrate.

________________________________________________________________________________________

1
A student set up an investigation into the effect of temperature on the rate of photosynthesis in a green plant, by measuring the volume of oxygen released in one hour.

The results are shown in the table.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Volume of oxygen released in one hour (cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experiment 1</td>
</tr>
<tr>
<td>10</td>
<td>0.7</td>
</tr>
<tr>
<td>20</td>
<td>1.6</td>
</tr>
<tr>
<td>30</td>
<td>2.7</td>
</tr>
<tr>
<td>40</td>
<td>2.0</td>
</tr>
<tr>
<td>50</td>
<td>0.3</td>
</tr>
</tbody>
</table>

(a) On the grid, plot a line graph to show the effect of temperature on the average volume of oxygen released in one hour.

(b) Predict the average volume of oxygen released in one hour if the experiment was carried out at a temperature of 60 °C.

____ cm³
(c) State one factor, other than temperature, which can limit the rate of photosynthesis.

(d) The diagram represents the second stage of photosynthesis.

![Diagram of photosynthesis stages]

Name substances X and Y.

X _____________________________

Y _____________________________

3. The graph below shows how the rate of photosynthesis is affected by the concentration of carbon dioxide.

![Graph showing rate of photosynthesis vs. carbon dioxide concentration]

State two environmental factors which could limit the rate of photosynthesis between points P and Q.

1. _____________________________

2. _____________________________
4. The graph below shows how the rate of photosynthesis is affected by light intensity at different concentrations of carbon dioxide.

a. Which factor was limiting the rate of photosynthesis at points 1 and 2?

Point 1 ________________________________ 1

Point 2 ________________________________ 1

b. Name one other factor that can limit the rate of photosynthesis.

______________________________ 1
Homework Exercise 4: Energy in Ecosystems

1. On average, 90% of energy is lost at each energy transfer in a food chain. Which of the following is a cause of this energy loss?
   A. Digested material
   B. Cell repair
   C. Movement
   D. Growth

2. The diagram represents a pyramid of energy.

![Pyramid Diagram](image)

There is less energy at level X in the pyramid because
   A. there are fewer organisms at each level in the food chain
   B. the organisms at level X are very small
   C. energy is lost at each level in the food chain
   D. energy is stored in each level and not passed on.

3. The diagram below shows the pyramid of numbers for a food chain of a coastal bay.

```
common tern
  billfish
    silversides
      plankton
```
a. Present the information in the diagram as a food chain.

b. Use the diagram above to explain what is meant by the term *pyramid of numbers*.

c. What other feature of a food chain can be represented as a pyramid?

d. What type of producer may produce a pyramid of numbers like the one shown below?

![Pyramid Diagram]

4. In transfers from one level to the next in a food chain, the majority of energy is lost. Name three ways in which energy is lost.

5. The diagram below shows the number of organisms at each level in a pyramid of numbers.

![Organism Numbers]

How many organisms are consumers?
6. The diagram shows a food web from a moorland ecosystem.

(a) The following statements refer to the food web.
Complete the table by entering “T” when the statement is true, and “F” when the statement is false.

<table>
<thead>
<tr>
<th>Statement</th>
<th>T or F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linnets are eaten by beetles and moths.</td>
<td></td>
</tr>
<tr>
<td>Foxes and hen harriers are not eaten by anything.</td>
<td></td>
</tr>
<tr>
<td>Butterflies are eaten by skylarks which are eaten by foxes.</td>
<td>1</td>
</tr>
</tbody>
</table>

(b) Give an example of a producer and a consumer from the food web.

Producer __________________________

Consumer __________________________ 1

(c) Which plant provides energy for the greatest number of different species in this food web?

______________________________ 1

(d) Give two ways in which energy can be lost from this food web.

1 _________________________________

2 _________________________________ 2
1. The effect of different concentrations of nitrate fertiliser on the yield of two different crops is shown in the table below.

<table>
<thead>
<tr>
<th>Concentration of fertiliser (kg/Ha)</th>
<th>Yield of crop (kg/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop A</td>
</tr>
<tr>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>40</td>
<td>290</td>
</tr>
<tr>
<td>80</td>
<td>400</td>
</tr>
<tr>
<td>120</td>
<td>460</td>
</tr>
<tr>
<td>160</td>
<td>470</td>
</tr>
</tbody>
</table>

(a) Using the same axes, show these results as two line graphs.

(b) Draw two conclusions from this information.

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

2. ........................................................................................................
........................................................................................................
2. The graph shows the average wheat yields in the USA and in Europe from 1750 to 2000.

(a) Describe the pattern of average wheat yield for the USA from 1750 to 2000.
3. 

(b) During which 50 year period was there the greatest increase in average wheat yield in Europe?

from ________ to ________

(c) Calculate the simple whole number ratio of average wheat yield in Europe to that in the USA in 2000.

*Space for calculation.*

\[
\begin{array}{c}
\text{Europe} \\
\text{USA}
\end{array}
\]

3.

Certain varieties of potato plant are eaten by beetles, reducing the yield of potatoes. A beetle-resistant variety of potato plant was developed.

In an investigation, the beetle-resistant variety was grown outdoors in one field and the non-resistant variety grown in another.

The yields of both varieties were recorded and the results are shown in the graph below.

(a) Describe how the reliability of these results could be increased.

---
(b) Calculate the difference in yield between the two varieties.  

\[
\text{Space for calculation}
\]

\[\text{kg per hectare}\]

(c) Identify a variable that would have to be kept the same between the two fields to ensure the results were valid.

\[\text{Name one of these methods.}\]

(d) Genetic engineering was used to develop the beetle-resistant variety of potato plant.  

Before the development of genetic engineering, farmers used other methods to control the beetle numbers in their potato fields.  

\[\text{Name one of these methods.}\]

4.

The following graph shows the changes in wheat yield over a fifty-year period.

The percentage increase in wheat yield from 1950 to 2000 is

A 5  

B  40  

C  250  

D  350.
5.
A gardener treated the soil in the area where he planted vegetables with a chemical to increase the yield.

(a) (i) The chemical added to the soil by the gardener contained nitrates.
Give the general name for this type of chemical. 1

(ii) Describe the use that plants make of nitrates. 1

(iii) When the vegetables were picked and weighed, the total yield was 42 kilograms. The previous year the total yield was 35 kilograms.
Calculate the percentage increase in yield. 1

Space for calculation

(b) Later in the year the gardener noticed that the algae in his pond had increased and now covered the surface of the water. He sampled the pond water over 5 weeks and measured its oxygen concentration and number of bacteria present.
The results are shown in the graph.

![Graph showing Level vs. Time and Number of Bacteria vs. Oxygen Concentration](image)

(i) What name is given to the increased growth of algae in the pond? 1

(ii) Explain why the increased growth of algae resulted in an increase in the number of bacteria. 1
6. Which of the following statements describes the sequence of events when fertiliser leaches into a loch?

A. algal blooms develop → algae die → oxygen concentration decreases
B. algal bloom develops → algae die → oxygen concentration increases
C. oxygen concentration increases → algal bloom develops → algae die
D. algae die → oxygen concentration decreases → algal bloom develops

1

7. Insecticides are often found in the body tissues of larger organisms after it has entered the food chain. Which term describes this build up?

___________________________________________

1

8. The diagram below shows the uptake of a chemical group, from the soil, which the plant uses to produce proteins.

a. Name chemical X.

______________________________________________

1
b. If the soil runs out of chemical group X fertilisers can be added. Explain how fertilisers can decrease biodiversity within an aquatic ecosystem.

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

1

c. State one way to reduce the use of fertilisers.

_________________________________________________________________________________

1

d. Farmers use pesticides to kill pests that consume their crops. State one way that could act as an alternative to using pesticides.

_________________________________________________________________________________

1
Homework Exercise 6: Evolution of Species

1. Decide if each of the following statements about evolution is True or False and tick (✓) the appropriate box.

   If the statement is False, write the correct word in the Correction box to replace the word underlined in the statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genetic variation within a population allows the population to adapt in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a changing environment.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Isolation barriers can be geographical, environmental or reproductive.</td>
<td></td>
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</tr>
<tr>
<td>Sub-populations evolve until they become genetically identical.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Mutations result in changes to genetic material.

   Which of the following is not true of mutations?

   A  Radiation can increase their rate.
   B  They always have a harmful effect.
   C  Genetic material is affected at random.
   D  New alleles may be produced.

3. Natural selection occurs when there are selection pressures.

   Which of the following could be a result of selection pressures?

   A  Organisms with favourable alleles survive and reproduce.
   B  Organisms with new alleles always have an advantage.
   C  All alleles in a population increase in frequency.
   D  All alleles in a population decrease in frequency.
4. Speciation occurs after part of a population becomes isolated by an isolation barrier. Complete the following table to show each type of barrier and two examples of each type.

<table>
<thead>
<tr>
<th>Type of Barrier</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pH and salinity</td>
</tr>
<tr>
<td>Behavioural</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. The following diagram shows the stages in the formation of a new species.

Using the information in the diagram, describe how new species are formed.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

__________________________________________________________________________
The map below shows the locations of six populations of the house mouse on the island of Madeira. Studies have shown that speciation is occurring.

a. Using the information in the diagram, name the type of isolation barrier involved in the speciation of the mice.
   
   ____________________________________________________________________________ 
   1

b. Explain the importance of isolation barriers in the evolution of a new species.

   ____________________________________________________________________________

   ____________________________________________________________________________ 1

   ____________________________________________________________________________

   ____________________________________________________________________________

   ____________________________________________________________________________ 1

c. How could it be confirmed that the population of mice had evolved to become two separate species?

   ____________________________________________________________________________

   ____________________________________________________________________________ 1