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Life Sciences

Information sheets

This pack of **Information sheets** for the study of the **Life Sciences Grade 12 CAPS curriculum** will support your learners on the road to success. Learners can work through these individually at home or these could form the basis of a catch-up class or online lesson. You have permission to print or photocopy this document or distribute it electronically via email or WhatsApp.

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Information sheet 1: Mathematical skills in Life Sciences

Mathematical skills are an important part of Life Sciences.

Scales

Scales are used to determine the actual size of an object that is reduced in size in a diagram, for example calculating the width of the stomach in Figure 6. You are expected to measure the width of the stomach and then multiply this by the scale given in the diagram. For example, if the width of A in Figure 6 is 13 mm, then the actual width is 13 × 5 which is equal to 65 mm (because the scale is 1:5).

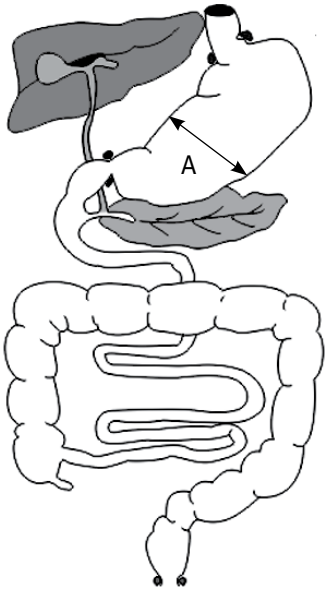

Figure 6 Part of the human digestive system. Scale of drawing: 1:5

Scales are also used to determine the actual size of a drawing/diagram of some organism/organelle that is microscopic, for example calculating the actual length of a microscopic bacterial cell. You need to measure the length using a ruler and then divide this figure by the magnification indicated below or in the drawing.

Averages

To find the average, you find the sum of all the items and divide this total by the number of items.

Example: In a class of 10 learners, the following marks were obtained in a test:

85, 54, 67, 90, 95, 80, 60, 50, 35, 40.

Total = 656 (Add all ten figures)

$$\text{Average} = \frac{656}{10}$$

$$= 65{,}6$$

Formulae

A formula is used in certain types of calculation. In Mathematics you learnt to substitute numbers into a formula. Exactly the same procedure is used when using formulae in other subjects.

Example 1: Simple sampling:

$$\text{Estimated total number of individuals in a population} = \frac{\text{number of individuals in sample area} \times \text{habitat size}}{\text{sample size}}$$

Example 2: Mark-recapture experiments:

$$N = \frac{C \times M}{R}$$

where:

N = estimated population size

C = total number of individuals captured

M = total number of marked individuals

R = total number of marked individuals recaptured

Information sheet 2: Study methods and exam tips for Life Sciences

We all have to pass exams in order to progress through the education system and make our way in the world. With the correct preparation and approach, exams need not be a hurdle, but can become a way of showing what you know and also a way to help you organise your knowledge logically.

Study methods

We all have different ways of studying. Some people work hard and consistently all the way through the term and then spend very little time revising for exams. Other people find that they need lots of revision time close to the exam. No one way is right. As you progress through the education system, you will work out what is right for you.

There are some basic tips that are helpful to everyone:

- Find a quiet place to study. If this is not possible at home, try to use areas of your school during the day or your local library when you cannot use the school premises. Make sure that your study area is well lit and comfortable.
- Sit at a desk. Very few people can study effectively in an armchair or in bed.
- Let others in the household understand that you need dedicated time to study and that they must not interrupt you unless it is absolutely necessary.
- Work hard, but not so hard that you become over-tired.
- If you play a sport or do regular exercise, do not stop. Just make sure that you fit this in around your studying and not the other way around.
- You may need to neglect your social life for a while. Relax quietly with music or family rather than going out with friends, which could lead to late nights and poor concentration the next day.
- Get enough sleep. Most people need seven to eight hours a night and you remember better if you are getting enough sleep.

Specific study tips:

- Before you start to revise, make sure that you know exactly what material you have to cover for a particular exam. Look at the contents page of this study guide and your other textbooks. This is the material that you need to cover.
- Gather all your reference material together, including summarised notes, if you have prepared them.
- If you have not prepared summarised notes, now is the time to do so.
- Decide on specific times during the day or evening when you are going to study. Stick to this schedule as far as you can.
- Make a revision timetable.
- Study actively. Do not just sit and try to memorise information. Use notes, concept maps and key words, and draw labelled diagrams.
- Test yourself regularly by answering practice questions. Explain concepts to other members of the family. You need to know something well before you can explain it to someone else.
- Take regular breaks. Get up and walk around, preferably outside. Eat frequent snacks to keep your energy levels up. Do not drink too much coffee.

Exam technique

The night before an exam:

- Never try to cram in final bits of knowledge.
- Gather together everything you will need for the exam the next day, such as pens and pencils.
- Make sure that you know the time that the exam starts and where the exam is being held.
- Set your alarm so that you get up in good time, can eat a good breakfast and have plenty of time to get to the exam.
- Get a good night's sleep.

The exam:

- Read the instructions on the paper carefully and take note of any comments made by the invigilator.
- Read through the whole paper carefully before you start answering questions.
- If there is a choice of questions, put a mark next to the questions that you know you can answer well.
- Note the time allowed for the examination and the number of questions that you have to answer. Divide your time carefully so that you answer the full number of questions that are required. If you leave out questions, you will lose a lot of marks.

- In multiple-choice questions, read each question and think carefully before you answer. Do not guess.
- Read short-answer and structured questions carefully. Arrange your answers clearly and logically, using notes if you prefer. Do not make vague and unclear statements. Make sure that you answer the question that is asked.
- In questions that allow you a free response or a short essay, take the time to note down the main points that you need to cover. This helps you to remember the material and allows you to organise your thoughts so that you can write the answer down clearly.
- Draw diagrams and graphs clearly and label them correctly. Make them a size that the examiner is going to be able to mark easily.
- Arrange your time so that you have a few minutes at the end of the exam to go through your questions and answers to check them.

Stock questions on investigations

1. Suggest a hypothesis.
2. What is the aim of the investigation?
3. Identify the:
   - independent variable/s
   - dependent variable/s
   - fixed variable
4. Name the variable/factor that is controlled by the investigator.
5. Describe the results of the investigation.
6. Predict the results of the investigation.
7. How can the design of the investigation be changed to obtain more reliable results?
8. Describe a control for the investigation.
9. State a conclusion from the results of the investigation.
10. Is the conclusion a valid one? Explain.
11. Do the results support the hypothesis?
12. Plot a line graph of the results.

Answering essay questions

The essay is found in Section C of the final examination question paper. The content of the essay is worth 17 marks and the synthesis, which assesses whether your essay has been answered with insight, understanding, and logical sequence, is allocated three marks.

When answering the essay question, step-wise planning is required.

Using the essay question below, let us see how we can answer it to get maximum marks.

Essay

Describe how the principle of negative feedback operates in controlling the glucose concentration of the blood in a healthy person without the disease. Also describe the causes, symptoms and management of the disease, diabetes mellitus, which results from an inability of the body to normalise the glucose concentration of the blood.

Mark allocation:

Content (17) + Synthesis (3) = Total (20)

Step 1

Read the essay thoroughly to determine the topic/s that is/are being covered. Underline the key words in the question paper.

Homeostasis – since *negative* feedback is asked for.

Endocrine system – since the *hormones that control glucose concentration* is asked for.

Step 2

Interpret and analyse the essay question. Identify each aspect/part of the question that is being asked for – you cannot afford to leave out anything.

- You need to describe how glucose concentration is controlled. You must include how this control is achieved when the glucose level is **high** and when the glucose level is **low**. This is the basis of a negative feedback mechanism.
- The question also asks for **causes** of diabetes, **symptoms** of diabetes and **management** of diabetes.

Step 3

Write the first draft of the essay in a logical and organised manner, linking each aspect that is discussed.

Your plan or draft of the essay may take the form of a flow diagram as you have learnt it step by step as shown in the two tables below.

The regulation of glucose levels in the blood.

SITUATION 1 When the glucose level is **high**	
1	Glucose levels in the blood **increase** above normal levels
2	Pancreas is stimulated
3	Pancreas secretes **insulin** into the bloodstream
4	Insulin travels in the blood to the liver
5	In the liver insulin stimulates the conversion of excess glucose to glycogen which is stored
6	The glucose level in the blood **decreases**
7	The glucose level in blood returns to normal

SITUATION 2 When the glucose level is **low**	
1	Glucose levels in the blood **decrease** below normal levels
2	Pancreas is stimulated
3	Pancreas secretes **glucagon** into the blood
4	Glucagon travels in the blood to the liver
5	In the liver glucagon stimulates the conversion of stored glycogen to glucose
6	The glucose level in the blood **increases**
7	The glucose level in blood returns to normal

Causes of diabetes mellitus

Inadequate secretion/non-secretion of insulin; production of defective insulin; body cells resistant to the action of insulin; inability of the cells to use glucose efficiently

Symptoms

Glucose in the urine; frequent urination; extreme thirst; fatigue, lethargy, faintness, nausea, vomiting, weight loss, blurred vision; non-healing of wounds

Management of diabetes mellitus

Exercise/eating diet suitable for diabetic person; using prescribed medication/drugs for the management of diabetes mellitus

Step 4

Write out the final version of your essay in full sentences. Put a line across the plan/draft of the essay so that the marker assesses your final answer and not your plan/draft.

Step 5

Read the question once more to check if your answer corresponds to the question. Now, proofread your essay carefully. This is your opportunity to pick out any spelling errors or incomplete words, sentences or ideas.

Information sheet 3: Notes on specific study areas for Life Sciences

Questions that involve comprehension and extracting data from other material

These types of questions involve understanding or comprehending the information that is provided in extracts from other textbooks, scientific journals and newspaper and magazine articles. The extracts that you are given in the question are relevant to Life Sciences and its application to everyday life situations. The questions that are set on these extracts assess how well you can understand the information in the extract and how you interpret any data that the extract contains.

These are the important points to note when you are answering a comprehension question:

- Read the extract thoroughly before you look at the questions. Ask yourself if you understand the information that is in the extract.
- If there are words that you do not understand, look at how they are used in the extract and see if you can work them out from the context.
- Now look at the questions. All the information that you need to answer the questions will be in the extract that you have been given. Remember this!
- Take each question in turn and go back through the extract to find the answer. You can use the wording in the extract to help you to put your answer together. Remember that the answers to the questions must be based on the information that is in the extract that you have been given.
- Practise answering comprehension questions using the questions in this book.
- If you have trouble constructing sentences in English, use notes for each answer. As long as all the correct information is in your answer, you will get the marks that you need.

Drawings and diagrams

Drawings and diagrams are essential in any science and are particularly important in Life Sciences because you use them to interpret what you see, for example when you look at a specimen under the microscope or when you understand how the human body works. But there are rules about scientific drawings and diagrams. Remember that your drawing or diagram is not a sketch. It is an easy-to-understand representation of what you see.

Rules for drawings and diagrams

There are general rules that you need to follow when doing drawings and constructing diagrams.

Drawings and diagrams must:

- be drawn in pencil (using a sharp HB pencil to draw clear smooth lines)
- be labelled in ink
- be large enough (at least half of an A4 page) to see all the structures that are in the diagram
- be positioned in the centre of the page
- usually be two-dimensional (i.e. show length and width only)
- not be shaded
- have a title/caption below them.

The following rules apply to the title/caption:

- Remember that a biological specimen can be sliced in different ways. This is the section of the part, i.e. whether it is the transverse section (T/S), cross section (C/S), or longitudinal section (L/S).
- The caption should show the source of the diagram, i.e. whether it is from a specimen, a micrograph or a slide.
- The magnification/scale of the drawing should be placed either in the caption or in one corner of the drawing itself.

Label lines must:

- be drawn in with a ruler (not hand-drawn)
- not cross each other
- not have arrows at the end
- touch the part/structure that is labelled
- be on one side of the diagram if there are few
- be used
- [illegible] the

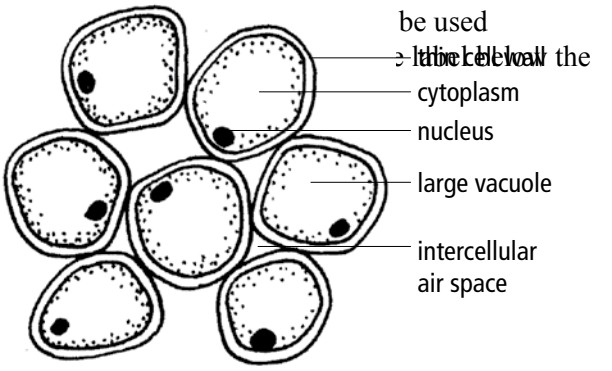

Figure 1 A drawing of a typical parenchyma

As an example, look at the label lines in the drawing in Figure 1.

The following assessment criteria will be used by teachers and examiners when they are assessing your diagrams:

- shape
- size
- proportion (if the different parts of the diagram are the correct size in relation to the size of the object being shown)
- position of parts
- caption
- magnification/scale
- labels
- neatness.

Tables

A table is used to organise and present the data that you have collected using as few words as possible. A table is used as a summary of data. A table is a rectangular grid that is divided into rows and columns. Rows run from left to right across the table.

The shaded area in the table below illustrates a row (made up of three cells).

Columns are the vertical blocks of a table. The shaded area in the table below illustrates a column (made up of four cells).

Tables can be simple (made up of two columns and a few rows) or complex (made up of many columns and many rows).

Tables can be used:

- to record the results of an investigation
- to illustrate certain patterns/trends, e.g. the growth of a population
- to compare things, e.g. different organisms/organs
- to summarise information
- to provide the data that you will use to construct a line graph, a bar graph or a pie chart.

A table should have a heading above it to state what type of information it contains. Each column and each row may have its own heading, with units where applicable.

As an example, look at the features of Table 1 below:

- It has a heading above it.
- It has two columns and eight rows.
- Each column has a heading.
- The first column should indicate the independent variable (*x*-axis – position of the lamp).
- The next column (and other columns, if applicable) should indicate the dependent/responding variable (*y*-axis – diameter of the pupil).
- Each piece of information is in a different cell.
- The table has 2 × 8 = 16 cells.

Table 1 The changes in the diameter of the pupil of the eye in response to light of different intensities

Position of the lamp	Diameter of the pupil (mm)
1	1,2
2	1,8
3	2,4
4	3,0
5	3,6
6	4,2
7	4,8

The following checklist or rubric may be used by your teachers and examiners to mark a table that you have put together:

Assessment criteria	1 mark	0 marks
Heading		
Informative column headings		
Informative row headings		
First column: independent variable		
Inclusion of units in headings		
No units in body of table		
Neatness		
Full set of results recorded		

Bar graphs

Bar graphs are used to represent data where the **independent variables**, that is, the variables on the *x*-axis, are each associated with something different. In other words, the bars on the graph compare different facts or information. The example that you have been given shows the different types of transport that different learners use to reach school.

There is no relationship between the different types of transport, so a bar graph is the best way to represent the data.

When you construct a bar graph, remember:

- The bars must be of the same width and must be the same distance apart from each other.
- The bar graph can be presented vertically or horizontally.
- A bar graph must have a caption.
- The independent variable (*x*-axis) and the **dependent variable** (*y*-axis) should each be labelled. Remember to use units if this is necessary.

The following table and the bar graph drawn from the data in the table show how a bar graph should be drawn.

Example: The following table and bar graph represent the type of transport that various learners in a class use to get to school:

Table 2 Methods used by learners to get to school

Type of transport	No. of learners using this method
Walking	26
Bicycle	2
Taxi	1
Bus	3

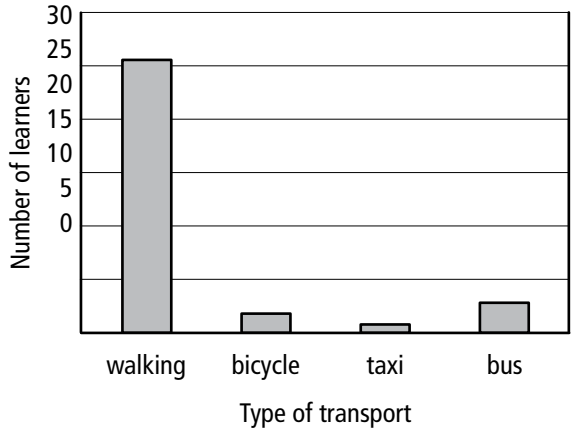

Figure 2 A bar graph showing the methods used by learners to get to school

Histograms

A histogram is a type of bar graph. A histogram is used to represent data when the independent variable (*x*-axis) represents groups of information along a continuous scale. Histograms are similar to bar graphs, except that in histograms there are no spaces between the bars because each bar is showing data that are related to each other in some way, so the bars are continuous (next to each other).

The bars can be drawn horizontally or vertically. When drawing the bars, make sure that they are all of the same width.

A histogram must have a title or caption. The independent variable (*x*-axis) and the dependent variable (*y*-axis) should each be labelled.

The following table and the histogram drawn from the data in the table show how a histogram should be drawn.

Example: The following table and histogram show the range of learners' marks in an assignment:

Table 3 Number of learners with a particular %

Range (%)	Number of learners with a particular %
0–9	0
10–19	0
20–29	2
30–39	3
40–49	4
50–59	7
60–69	10
70–79	6
80–89	3
90–100	0

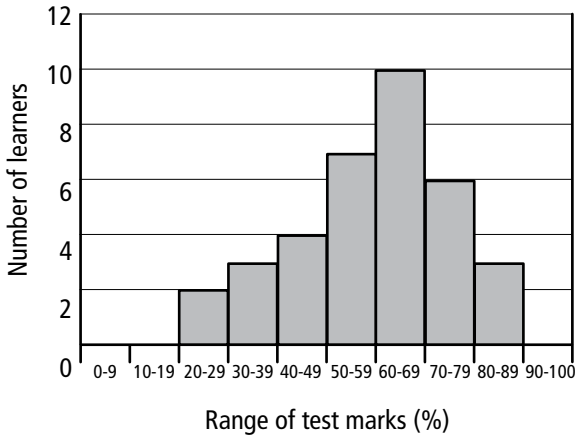

Figure 3 A histogram showing the number of learners with a particular percentage test score

The following rubric shows the criteria that your teachers and examiners could use to mark bar graphs and histograms:

Assessment criteria	1 mark	0 marks
Correct type of graph		
Title/caption of graph		
Correct choice and label for *x*-axis		
Correct choice and label for *y*-axis		

Appropriate units for *x*-axis		
Appropriate units for *y*-axis		
Appropriate scale for *x*-axis		
Appropriate scale for *y*-axis		
Bars drawn correctly		

You will lose marks if:

- you draw the wrong type of graph or you draw the bars incorrectly. Remember that a bar graph is used when the data are not related to each other and a histogram is used when the data are related.
- you draw the axes incorrectly. Remember that the *y*-axis is always the vertical axis and the *x*-axis is always the horizontal axis.

Using line graphs

A line graph is used when the relationship between two variables can be represented in a continuous way. An example of a continuous relationship between variables is the effect of temperature on the rate of photosynthesis.

A line graph has the following features:

- A horizontal axis called the *x*-axis for the independent variable or *manipulated variable*. This represents the variable that is controlled or changed during the investigation to determine what effect it has. This axis must be appropriately labelled with the units, e.g. Temperature (in degrees Celsius).
- A vertical axis called the *y*-axis for the dependent variable or *responding variable*. This is the response that is measured or monitored during the investigation. In other words, it is the variable that reacts or which is measured or calculated. The axis must be appropriately labelled with units, e.g. Number of bubbles of gas produced per minute.
- An appropriate scale to represent data. The points plotted should use most of the axis, i.e. the available space. In order to do this, you must study the range of readings and then work out the lowest and the highest values for each scale. The scale you choose should always be in a regular sequence, that is, all scale divisions must be equal, e.g. 4 in 4, 8, 12, etc. Each axis must be labelled with the appropriate units and what is shown on each axis. Using the example of the effect of temperature on the rate of photosynthesis: the temperature would be on the *x*-axis – labelled Temperature (°C) and the number of bubbles of gas produced per minute would be on the *y*-axis – labelled Rate of photosynthesis (number of bubbles of gas produced per minute).
- Plotting the points. The data given in a table are then plotted on the graph. You use the X and Y coordinates to plot the points.
- The points are joined.
    - A ruler may be used to join points that lie on a straight line.
    - The points are not usually in an absolutely straight line because of experimental errors and variation. In such cases a line of best fit is drawn. Those points that do not fit should be distributed fairly evenly on either side of the line.
    - If the points appear to be following a curved pattern, then carefully draw a curve by joining all the points. Do not draw short interrupted lines.
    - Only begin the graph at 0 when there are values for 0. If there are no values for 0, then start the graph at the first plotted point.
- Each graph must have a clear, descriptive title showing the relationship between the variables. For example, "The effect of temperature on the rate of photosynthesis".
- If more than one graph is drawn on the same set of axes, a key should be included or a dotted and solid line should be used and labelled.

Reading values off a line graph

When reading information from a graph, use a dotted line that extends from a point on the *x*-axis to the line that you have drawn on the graph. Where this dotted line intersects with the line on the graph, draw a broken line across to the *y*-axis and read the value at this point where the dotted line touches the *y*-axis.

Example: Using the graph below, determine how long it took for the plant to release 30 bubbles.

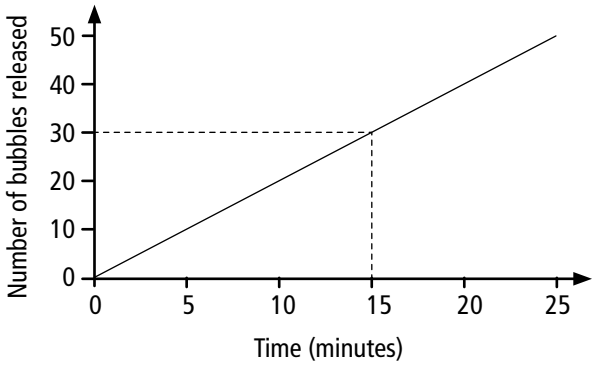

Figure 4 Line graph showing the relationship between number of bubbles released by a plant and time

Your reading shows that it took 15 minutes for the plant to release 30 bubbles of gas.

Your teachers and examiners will use the following criteria to assess how you have drawn a line graph:

Assessment criteria	1 mark	0 marks
Correct type of graph		
Title of graph		
Correct choice and label for *x*-axis		
Correct choice and label for *y*-axis		
Correct units for *x*-axis		
Correct units for *y*-axis		
Appropriate scale for *x*-axis (constant intervals)		
Appropriate scale for *y*-axis (constant intervals)		
Points plotted correctly		
All plotted points joined correctly		

Pie charts

A pie chart shows data as a percentage or as a relative proportion of the total of a circle. You draw a pie chart by dividing a circle into sectors/slices (think of a pizza) to represent each item as a percentage of the whole. A complete circle represents the whole or 100%, a half-circle represents 50%, and so on.

First calculate the percentages that you will use for each slice. You can then calculate the angle of each of the slices using the following formula (remember that there are 360° in a circle):

$$a = \frac{v \times 360}{t}$$

where:

a is the angle of the slice/vector

v is the amount of the variable

t is the total (100 in the case of percentage).

Example: In an ecosystem, 41 insects (ants, butterflies, and so on), two reptiles (lizards), three arachnids (spiders) and four birds were counted. This gives a total of 50 animals. Use a pie chart to represent the percentage of each type of animal present in the ecosystem.

The percentage and degrees (using the formula) have been worked out and recorded in the table below:

Animals	%	Sector/slice
Insects	$\frac{41 \times 100}{50} = 82\%$	$\frac{82 \times 360}{100} = 295{,}2°$
Reptiles	$\frac{2 \times 100}{50} = 4\%$	$\frac{4 \times 360}{100} = 14{,}4°$
Arachnids	$\frac{3 \times 100}{50} = 6\%$	$\frac{6 \times 360}{100} = 21{,}6°$
Birds	$\frac{4 \times 100}{50} = 8\%$	$\frac{8 \times 360}{100} = 28{,}8°$

Constructing the pie chart:

1. A compass may be used to draw the circle and a protractor may be used to construct accurate angles for each sector or slice.
2. Begin with the largest angle/percentage starting at 12 o'clock. In the example above: insects 295,2° or 82%, then the next largest, and so on.
3. Shade and label each slice and/or provide a suitable key. For example:

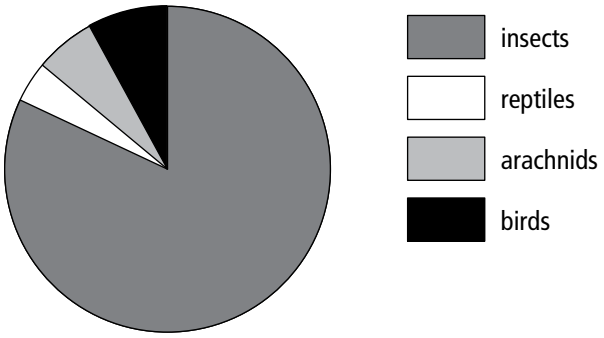

Figure 5 Pie chart showing the percentage of each animal type present in the ecosystem

Your teachers and examiners may use the following criteria to assess your pie chart:

Assessment criteria	1 mark	0 marks
Correct type of graph		
Suitable title/caption		
Appropriate labels/key		
Calculating % of each sector/slice		
Calculating degrees of each sector/slice		
Sectors/slices drawn correctly		