Government of **Western Australia**
School Curriculum and Standards Authority

SAMPLE ASSESSMENT TASKS

INTEGRATED SCIENCE
GENERAL YEAR 12

Sample assessment task

Integrated Science – General Year 12

Task 1 – Unit 3

Assessment type: Science inquiry

Conditions
Period allowed for completion of the task
    Research: one week
    Excursion: one day
    Analysis of data: two 60-minute lessons

Task weighting
6% of the school mark for this pair of units
_____

Investigation – Measuring and comparing the abiotic factors of two aquatic ecosystems

(43 marks)

Background information
The abiotic or non-living factors in an ecosystem include: temperature, turbidity, pH, dissolved oxygen, nitrate levels and phosphate levels. These non-living factors can have considerable impact on freshwater ecosystems, particularly if they impact on autotrophic organisms (also known as producers).
A summary of some abiotic factors is found below.

1.   **Temperature**
Organisms have an upper and a lower temperature limit beyond which growth and reproduction will stop. There is an optimum temperature range within which maximum growth occurs. Water temperature decreases as the depth of the water increases. Temperature can also affect other abiotic factors, such as the amount of dissolved gases that can be held within the water body. Most local fish prefer temperatures of between $15\,^{\circ}C$ and $25\,^{\circ}C$. Fish can survive warmer water, but only for short periods of time.

    Temperature is measured with a thermometer.

2.   **Turbidity**
Turbidity is the measure of the amount of finely divided solids suspended in the water. These suspended solids may consist of plankton, organic and inorganic detritus, sand, clay or silt. These occur naturally in bodies of water, but may be added to by human activity. Increased levels of turbidity can affect aquatic organisms in several ways. Turbidity can:
- reduce the amount of light available to photosynthetic organisms, reducing aquatic plant growth
- affect food available for consumers
- affect gas exchange in organisms (silt blocking gas-exchange surfaces)
- act as a transporting medium for pollutants such as pesticides and heavy metals.

    Turbidity is measured with a turbidity tube.

3. **pH**

pH is the measure of how acidic or basic a solution is. The normal range of pH in a freshwater system is between 6.0 and 9.0. A change in pH can have serious effects on the life in an aquatic ecosystem. It can cause the death of fish, larvae and eggs and it may also reduce the productivity of organisms. Higher levels of carbon dioxide in the water will lower the pH of the water, making it more acidic. The ideal range for freshwater aquatic organisms is between 6.5 and 8.

pH is measured with universal indicator and a pH chart.

4. **Dissolved oxygen**

Most organisms require oxygen for survival. Oxygen is available in the water in a dissolved form. The oxygen is produced from photosynthetic activities of water-living autotrophs (producers), diffusion at the air-water surface and mixing by wind. The level of oxygen is also directly related to:

- temperature – as the temperature of the water rises, the dissolved oxygen (DO) level falls and, as the temperature of the water falls, the DO level rises
- the amount of living material in a water body – the more organisms, including bacteria and fungi, the higher the level of biochemical oxygen demand and the lower the level of dissolved oxygen. Organisms are particularly sensitive to oxygen levels in their juvenile stages.

DO is measured in units of mg/L. The ideal range of DO for stream fish is 7–11 mg/L.

DO is measured using a DO meter.

5. **Nitrate**

About 80% of the air is nitrogen but most organisms cannot use it in this form. Nitrogen is needed to build proteins. Nitrogen found in the air can be converted into a useable form and released into the soil by organisms such as blue-green algae and some legumes. When an animal consumes a plant, it can then use this form of nitrogen. Nitrates contain nitrogen and usually enter aquatic ecosystems by the decomposition of dead plants and animals and their wastes. Humans introduce nitrates into these systems by sewage and excessive fertiliser use in gardens. The fertilisers end up in drains when sprinkler systems run onto roads and down drains. In some instances, it can lead to significant plant growth called algal blooms. These blooms initially produce greater quantities of DO; however, when they die, much more oxygen is consumed by the decomposers, leaving little oxygen available for other aquatic organisms. Nitrate levels are usually less than 1 mg/L. Concentrations over 10 mg/L will have an effect on any freshwater environment.

Nitrate levels are measured by nitrate probes.

6. **Phosphate**

Plants and animals require small doses of phosphorus (phosphates) for healthy growth and development. Freshwater ecosystems have very low supplies of phosphates compared with other ecosystems. Problems arise when there is a slight increase in these levels as this can also lead to algal blooms. Large streams have levels of phosphates around 0.1 mg/L while smaller streams have levels of only 0.01 mg/L. The impact is, therefore, much greater in smaller streams.

Phosphate levels are measured by the *total orthophosphate* test. The sample is added to chemicals and allowed to react. The chemicals turn dark blue when phosphate levels are high. A lighter shade of blue would indicate less phosphate in the sample.

Task

This task requires you to research the use of **two** different aquatic ecosystems (as directed by your teacher), attend an excursion, and present your findings in a scientific report. The **two** aquatic ecosystems have different surrounding land or water use. One of these is an area that has not been disturbed greatly by human activity and the other has significant development surrounding the area or catchment.

There are **three** phases to this assessment: pre-excursion, excursion and post-excursion.

Pre-excursion – Research and planning

In your research, you will determine to what extent the abiotic factors may be affected by the use of the land surrounding the aquatic ecosystem.

- Research the history of the two ecosystems. Research should include:
  - the use of the land surrounding the ecosystem
  - the possible effects of the land use on water quality
  - rainfall data for the ecosystem.
- Draw a landscape sketch of the two aquatic ecosystems, noting natural landforms and evidence of human activity. You may use Google Earth or any other suitable program or software.
- You will be allocated into a group of three. In your group:
  - practise using the following pieces of equipment:
    - thermometer (in air, water and mud)
    - turbidity tube
    - universal indicator and a pH chart
    - dissolved oxygen meter
    - nitrate probe
  - practise conducting the orthophosphate test on known concentrates.
- These pieces of equipment and tests will be used to measure **six** abiotic factors at your ecosystem.
- You must take readings at **five** different locations at each site. Discuss how your group will record the readings for each abiotic factor at the five different locations around the aquatic ecosystem. Remember you must average the data collected at each of the five locations at each ecosystem. Draw a table of results for the excursion.
- Each group must determine task responsibilities for each group member, at each ecosystem, to maximise the time available for the measurement of abiotic factors.

Excursion – Collection of data

Look at the first aquatic ecosystem and, in your group, decide on your **five** locations. You will take readings of the following **six** physical (abiotic) factors: temperature (air, water and mud), turbidity, pH, dissolved oxygen, nitrate and phosphate. On your landscape sketch, mark the five locations that you will collect physical data from.

- Before you commence, take notice of any disturbances caused by land use or evidence of human activity that you observe at the site. Record this information.
- Move to the first location and take and record the six abiotic factor measurements. Record this data.
- Continue until you have recorded the data for all five locations
- Repeat at the second ecosystem.

Post-excursion

Process, evaluate and communicate findings in a scientific report

1. Introduction:
   - provide a brief history of the land use and development of the area surrounding each ecosystem
   - discuss the possible effects of the land use on water quality
   - include rainfall data for the **two** locations
   - include a landscape sketch or photograph/s of each aquatic ecosystem   (8 marks)

2. Materials: outline the equipment used (include quantities)   (2 marks)

3. Method: describe the method used for gathering the data on the **six** abiotic factors
          (14 marks)

4. Results:
   - collate all the results for the physical measurements and land use observations
   - represent all the data in a table
   - include appropriate titles and headings
   - include a column for the average of the abiotic factors taken at the **five** sites at each ecosystem   (6 marks)

5. Discussion:
   - identify any differences between the two ecosystems
   - support your findings with data from the table
   - relate these differences to the history and land use surrounding the two ecosystems
   - account for any anomalous results
   - suggest ways in which the collection of data could have been improved   (8 marks)

6. Conclusion:
   - summarise your findings
   - suggest why there were differences between the **two** ecosystems
   - discuss how the differences in **three** physical factors can affect the organisms living in each ecosystem   (5 marks)

Marking key for sample assessment task 1 – Unit 3

1.   Introduction:
      - provide a brief history of the land use and development of the area surrounding each ecosystem
      - discuss the possible effects of the land use on water quality
      - include rainfall data for the **two** locations
      - include a landscape sketch or photograph/s of each aquatic ecosystem

Description	Marks
Brief history of the land use and development of the area surrounding each ecosystem	1–2
Possible effects of land use on the water quality of each ecosystem	1–2
Impact of rainfall data on physical factors at each ecosystem	1–2
Landscape sketch or photograph/s of each ecosystem	1–2
Answer could include, but is not limited to:	
Possible effects of land use and rainfall: • run off from farms or agricultural systems may increase phosphate and nitrate levels • constant movement of water may increase dissolved oxygen levels • shaded area may reduce water and mud temperature • deeper aquatic ecosystem may have lower temperatures • a high rainfall may dilute the impact of phosphate and nitrate run off • a low rainfall may concentrate nutrients and increase temperature as the ecosystem dries out	
Total	**/8**

2.   Materials: outline the equipment used (include quantities)

Description	Marks
Provides a comprehensive list of materials and quantities OR	2
List of materials and quantities included, but some omitted	1
Total	**/2**

3.   Method: describe the method used for gathering the data on the **six** abiotic factors

Description	Marks
Description of the procedure is clearly outlined in steps that can be followed	2
OR	
Description of the procedure is brief, but includes relevant aspects	1
Provides a description of the **six** sampling techniques	1–6
Answer could include, but is not limited to:	
• temperature – place the thermometer in the water and, after two minutes, read the scale (repeat this procedure for air and water) • turbidity – take a sample of water from the water source and pour it into the turbidity tube. Hold the tube in one hand and look into the open end with your head about 10 to 20 cm above the tube, so that you can clearly observe the black mark on the bottom of the tube. Stop pouring the water when mark on the bottom of the tube just disappears and read scale marked on the side • pH – take a sample of water in a mini vial and add five drops of the universal indicator. Using the universal indicator colour chart, match the colour to the pH chart • dissolved oxygen concentration – place the probe into the sample of water and record the dissolved oxygen concentration • nitrate level – place the probe into the sample of water and record the nitrate concentration • phosphate level – take a water sample and add the first reagent (ammonium heptamolybdate) and shake vigorously. Add the second reagent (stannous chloride). The chemicals turn dark blue when phosphate levels are high. A lighter shade of blue would indicate less phosphate in the sample	
Indicates the equipment used to measure the **six** abiotic factors	1–6
Answer could include, but is not limited to:	
• temperature – measured with a thermometer • turbidity – measured with a turbidity tube • pH – measured with universal indicator • dissolved oxygen concentration – measured with a dissolved oxygen meter • nitrate level – measured with a nitrate probe • phosphates – measured by the total orthophosphate test	
Total	**/14**

4.   Results:
*   collate all the results for the physical measurements and land use observations
*   represent all the data in a table
*   include appropriate titles and headings
*   include a column for the average of the abiotic factors taken at the **five** sites at each ecosystem

Description	Marks
Data included from all groups	1
Data represented in a well-constructed table	1–2
Appropriate titles for table	1
Column for each factor	1
Column for averages	1
Total	**/6**

5.   Discussion:
   - identify any differences between the two ecosystems
   - support your findings with data from the table
   - relate these differences to the history and land use surrounding the two ecosystems
   - account for any anomalous results
   - suggest ways in which the collection of data could have been improved

Description	Marks
Lists differences between the two locations	1–2
Supports the trends with data from the table	1–2
Relates the differences to the land use history	1–2
Accounts for anomalous results	1
Suggests ways in which the collection of data could be improved	1
Total	**/8**

6.   Conclusion:
   - summarise your findings
   - suggest why there were differences between the **two** ecosystems
   - discuss how the differences in **three** physical factors can affect the organisms living in each ecosystem

Description	Marks
Provides a summary of the findings at each ecosystem	1–2
Relates land use to the differences in physical factors	1–2
Relates differences in three physical factors to the organisms living in each ecosystem	1–3
Total	**5**
Answer could include, but is not limited to:	

One mark for one point from three physical factors
- higher temperature can lower dissolved oxygen concentration

AND/OR
- turbidity – increased turbidity can reduce the amount of available light for photosynthetic organisms
- this reduces aquatic plant growth which, in turn, affects food availability and oxygen concentration
- the suspended particles can also help transport pesticides and heavy metals

AND/OR
- pH – lower pH values can be a result of increased carbon dioxide levels which can affect the enzyme action of aquatic organisms, leading to death

AND/OR
- most organisms require oxygen for survival so lower oxygen levels caused by increased water temperatures or an increase in the number of organisms can be lethal

AND/OR
- increased nitrate levels can lead to significant plant growth called algal blooms (initially, the blooms produce greater quantities of dissolved oxygen; however, when they die, much more oxygen is consumed by the decomposers, leaving little oxygen available for other aquatic organisms)

AND/OR
- increased phosphate levels lead to algal blooms

Sample assessment task

Integrated Science – General Year 12

Task 3 – Unit 3

Assessment type: Test

Conditions
Time for the task: 50 minutes

Task weighting
4% of the school mark for this pair of units

_____

Earth systems/cycles in nature and structure and function of biological systems　　　**(54 marks)**

Part A: Multiple-choice　　　**(10 marks)**

This section has **10** questions. Answer all questions on the separate multiple-choice answer sheet.

1.　　The long-tailed mouse eats fungi, insects, spiders and fruits and is, therefore

　　(a)　　an autotroph.
　　(b)　　a detritivore.
　　(c)　　a herbivore.
　　(d)　　an omnivore.

2.　　Which of the following is an example of predation?

　　(a)　　A flea sucks the blood of a dog.
　　(b)　　A spider traps and eats a fly.
　　(c)　　A sea anemone hitchhikes on the shell of a crab.
　　(d)　　A lion kills a leopard in a fight.

3.　　An aquarium containing plants and invertebrates is completely sealed so that no organisms, gases or other matter can enter or leave. It is placed so that it receives six to eight hours of sunlight daily. After three months, living plants and invertebrates are still present in the aquarium. Which of these statements about the aquarium is correct?

　　(a)　　No energy has entered or left the aquarium.
　　(b)　　The total amount of carbon in the aquarium is reduced.
　　(c)　　The invertebrates in the aquarium cannot be competing.
　　(d)　　Some of the energy in the plants has moved to the invertebrates.

4. Use the pyramid of biomass below to answer the question that follows.

Trophic level
4

Trophic level
3

Trophic level
2

Trophic level
1
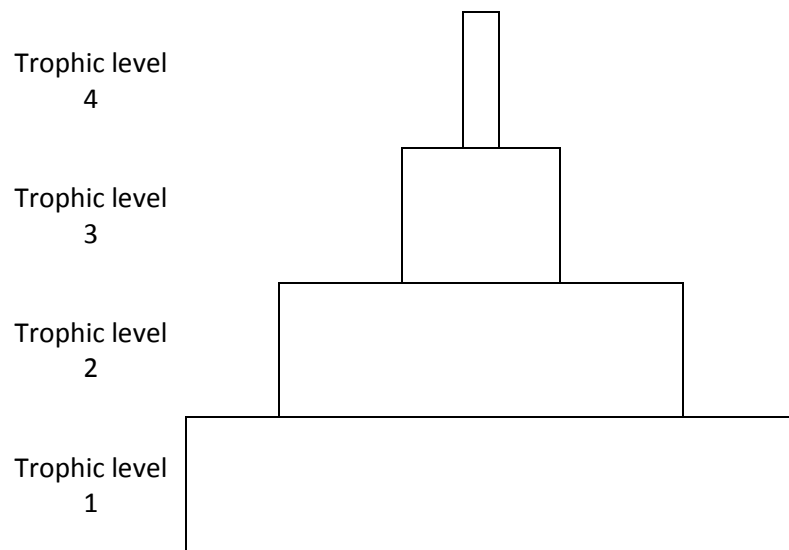
Approximately what proportion of the energy fixed in the bodies of primary producers in the food pyramid will be available to the first order consumers?

(a)   1
(b)   0.1
(c)   0.01
(d)   0.001

5. Examples of decomposers include

(a)   bacteria.
(b)   fungi.
(c)   bacteria and fungi.
(d)   producers.

6. Which of the following is the best example of symbiosis?

(a)   Fungi and algae live together. The algae provide food for the fungi and the fungi provide habitat for the algae.
(b)   A tapeworm lives within the gut of a dog. The dog's health declines as a result of the tapeworm and the tapeworm derives nutrients from the dog.
(c)   Ants live and work together to benefit the colony.
(d)   Mistletoe provides fruit and nesting sites for the mistletoe bird.

7. After a trip to a lake, four students each drew a food chain showing the feeding relationships between four of the organisms. Which of the students drew the chain correctly?

(a)   marsh harrier ⟶ blue-billed duck ⟶ snails ⟶ algae
(b)   algae ⟵ snails ⟵ blue-billed duck ⟵ marsh harrier
(c)   sun ⟵ algae ⟵ snails ⟵ marsh harrier ⟵ blue-billed duck
(d)   algae ⟶ snails ⟶ blue-billed duck ⟶ marsh harrier

8.   Which of the following would contribute to the turbidity of water?

   (a)   fine materials such as clay
   (b)   stains that have come out of plants
   (c)   microscopic algae that grow in the water
   (d)   all of the above

9.   Which of the following are abiotic factors?
   (i)   trees
   (ii)   reeds
   (iii)   water
   (iv)   pH
   (v)   ducks
   (vi)   air
   (vii)   fish

   (a)   (i), (ii), (iii)
   (b)   (iii), (iv) and (v)
   (c)   (iii), (iv) and (vi)
   (d)   (iv), (v), (vi) and (vii)

10. Some ants live in *Acacia* trees. The trees provide shelter and food for the ants. The ants attack animals that attempt to eat the *Acacia* trees. The relationship between the ants and *Acacia* trees is an example of

   (a)   mutualism.
   (b)   competition.
   (c)   parasitism.
   (d)   collaboration.

End of Part A

Part B: Short answer (44 marks)

This section has **six** questions. Answer all questions in the spaces provided.

11.   The diagram below shows how carbon cycles through an ecosystem.
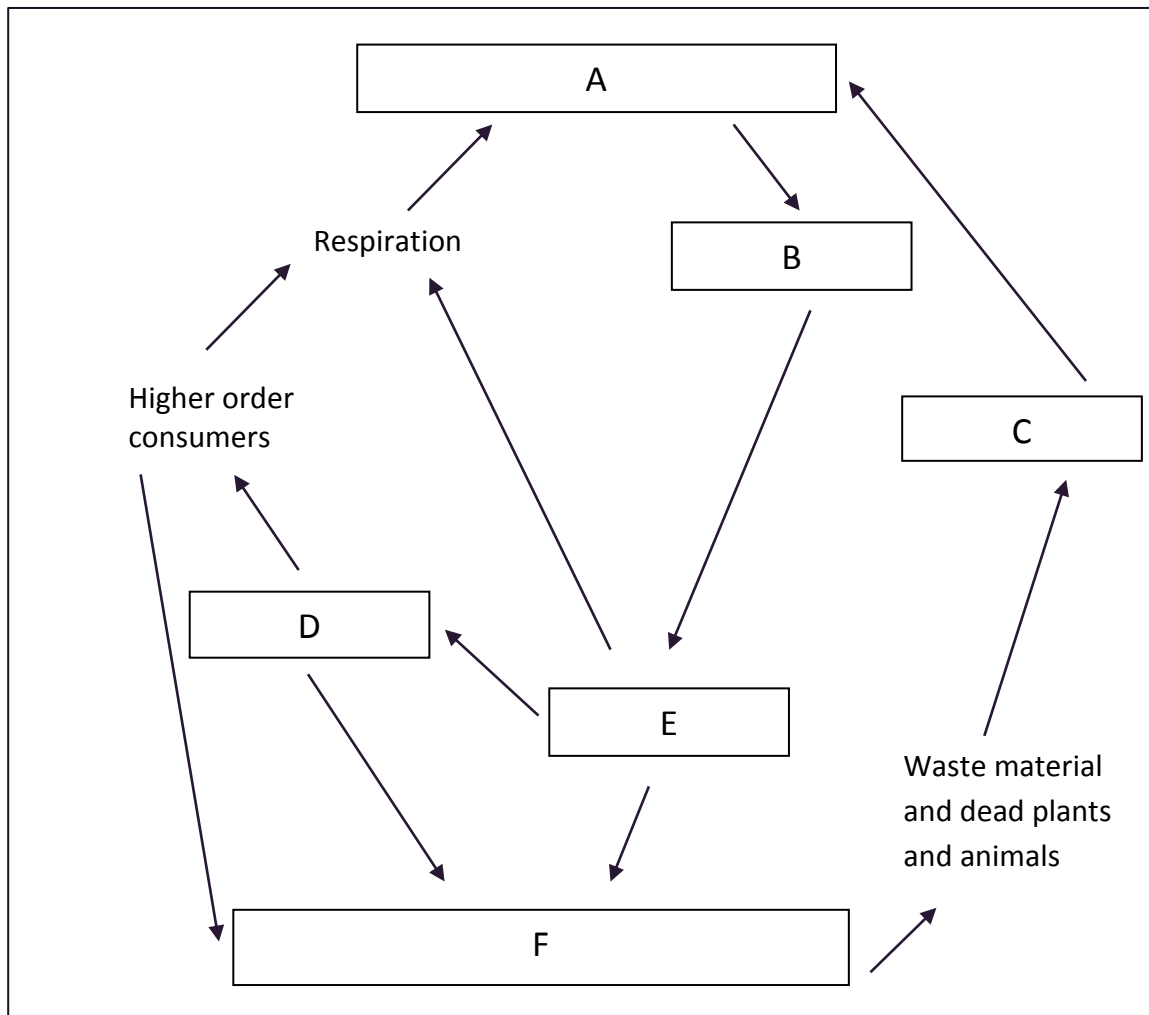
The following terms are missing from the diagram: herbivores (primary consumers), photosynthesis, the burning of fossil fuels, decomposers, plants (autotrophs), carbon dioxide in the atmosphere.

Match the terms with the correct label. (6 marks)

A _____

B _____

C _____

D _____

E _____

F _____

12. This question relates to the following diagram showing a simplified food web occurring in a freshwater lake community in Southern Australia.
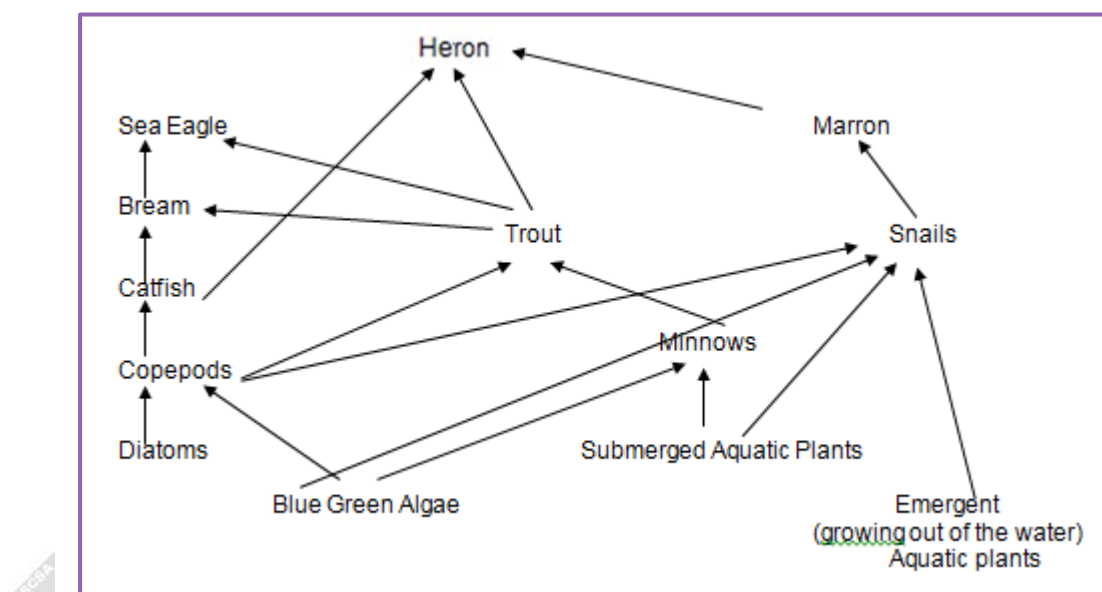
(a) Write **one** food chain from this food web. (1 mark)

_____

(b) For the food chain in (a), explain the following: (7 marks)
    (i) the original source of energy

    _____

    (ii) the way that energy became trapped and usable in the food web

    _____

    _____

    (iii) the way that energy passed through the food chain

    _____

    (iv) **three** different ways that energy may be lost in the food chain.

    _____

    _____

    _____

    _____

(c)   Using the food web, describe **three** impacts of an increase in nutrients flowing in the
waterway.   (3 marks)

_____

_____

_____

_____

(d)   Indicate whether each of the following statements about the relationships between
organisms in the freshwater lake community is true or false by circling the correct
answer. Give one reason for each of your answers.   (8 marks)

(i)   Heron and bream are competitors.

True/False

Reason:_____

_____

_____

(ii)   Minnows are predators to trout.

True/False

Reason:_____

_____

_____

(iii) A decrease in the number of minnows in the freshwater lake community is likely
to result in an increase in the number of trout in the lake.

True/False

Reason:_____

_____

_____

(iv) A decrease in the number of heron in the freshwater lake community is likely to result in an increase in the number of marron in the reserve.

True/False

Reason:_____

_____

_____

13. Distinguish between the following terms:

(a) competition and predation   (2 marks)

_____

_____

_____

_____

(b) parasitism and commensalism   (2 marks)

_____

_____

_____

_____

14. Seagrass meadows support diverse communities of organisms. The organisms in the seagrass meadows acquire nutrients in a variety of ways. State whether each of the following organisms is an autotroph, a herbivore, a carnivore, an omnivore or a detritivore.   (4 marks)

(a) marine worms that feed on dead pieces of seagrass plants _____

(b) photosynthetic algae that live attached to the seagrass plants_____

(c) fish that feed only on other fish _____

(d) dugongs (sea cows) that eat only seagrass plants _____

15. Some students in a class were investigating the relationship between water temperature and dissolved oxygen. They got some frozen ice blocks of distilled water and placed them in a container with a large opening at the top. They left the ice blocks until they melted and reached a temperature of 6^0C. Using an oxygen probe, they measured the level of dissolved oxygen in the water as the temperature of the water rose. The data is shown below.

(A gap in the data indicates the students failed to measure dissolved oxygen at this temperature.)

Solubility of Oxygen in Pure Water Saturated with Oxygen

Temperature (°C)	Dissolved Oxygen (mg/L)	Temperature (°C)	Dissolved Oxygen (mg/L)
6	12.0	14	10.0
7	11.8	15	
8	11.5	16	9.6
9		17	9.4
10	10.9	18	
11	10.7	19	9.0
12	10.4	20	
13			

(a) Draw a line graph using all of the data above on the grid below. (5 marks)
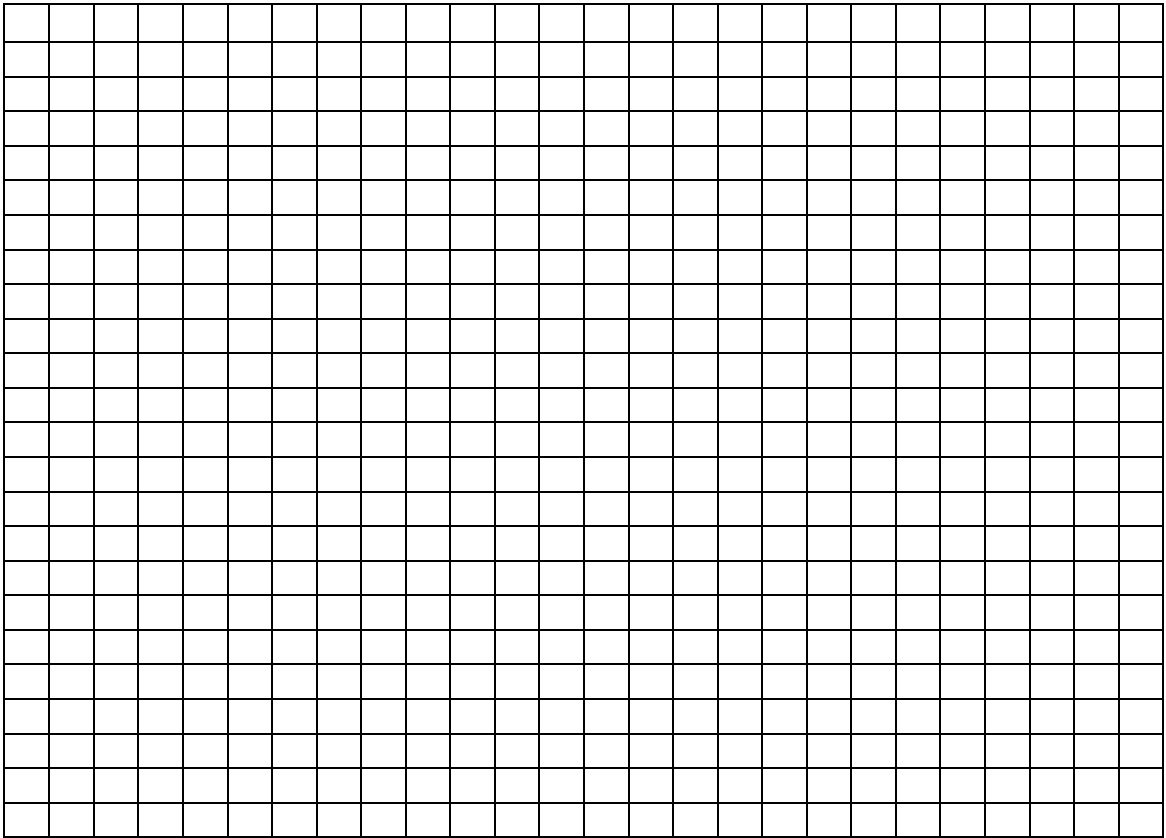
(b)   Use your graph to find the:

(i)   amount of dissolved oxygen present in water of 15°C in mg/L _____

(ii)   amount of dissolved oxygen present in water of 25°C in mg/L_____

(iii)   temperature at which water would contain 10.20 mg/L of oxygen in °C _____.

(3 marks)

(c)   Explain how an increase in temperature would affect the survival of organisms in a freshwater lake.   (3 marks)

_____

_____

_____

_____

_____

_____

End of test

Marking key for sample assessment task 3 – Unit 3

Part A: Multiple-choice

Description		Marks
Question	Answer	
1	d	1
2	b	1
3	d	1
4	b	1
5	c	1
6	a	1
7	d	1
8	d	1
9	c	1
10	a	1
	Total	**/10**

Part B: Short answer

11.   The following terms are missing from the diagram: herbivores (primary consumers), photosynthesis, the burning of fossil fuels, decomposers, plants (autotrophs), carbon dioxide in the atmosphere. Match the terms with the correct label.

Description	Marks
A: carbon dioxide in the atmosphere	
B: photosynthesis	
C: the burning of fossil fuels	1–6
D: herbivores (primary consumers)	
E: plants (autotrophs)	
F: decomposers	
Total	**/6**

12.   This question relates to the following diagram showing a simplified food web occurring in a freshwater lake community in Southern Australia.

   (a)   Write **one** food chain from this food web

Description	Marks
Answer must start with a producer and the arrow must show the direction of movement of energy from organism to organism	1
Answer could include, but is not limited to;	
blue-green algae ➔ copepods ➔ trout ➔ heron	
Total	**/1**

   (b)   For the food chain in (a), explain the following:

   (i)   the original source of energy

Description	Marks
the sun	1
Total	**/1**

(ii)   the way that energy became trapped and usable in the food web

Description	Marks
Photosynthesis	1
Light energy is trapped by the sun and incorporated into the plant tissue	1
OR	
Carbon dioxide + water (in the presence of sunlight and chlorophyll)	1
➤ sugar + oxygen	1
Total	**/2**

(iii)   the way that energy passed through the food chain

Description	Marks
By being eaten by another organism (the copepod's energy is passed to the trout when it is eaten)	1
Total	**/1**

(iv)   **three** different ways that energy may be lost in the food chain

Description	Marks
Any three ways that energy is lost	1–3
Answer could include, but is not limited to:	
• lost as heat to the atmosphere • movement • cell metabolism • when body products are lost (skin cells, feathers) • parts of the body are inedible	
Total	**/3**

(c)   Using the food web, describe **three** impacts of an increase in nutrients flowing in the waterway.

Description	Marks
Any three impacts of an increase in nutrients	1–3
Answer could include, but is not limited to:	
• (initially) more growth of producers/consumers • lack of light penetration • reduced producers/consumers • more decomposers • declining levels of dissolved oxygen	
Total	**/3**

(d)   Indicate whether each of the following statements about the relationships between organisms in the freshwater lake community is true or false by circling the correct answer. Give one reason for each of your answers.
(i)   Heron and bream are competitors.
(ii)   Minnows are predators to trout.
(iii)   A decrease in the number of minnows in the freshwater lake community is likely to result in an increase in the number of trout in the lake.
(iv)   A decrease in the number of heron in the freshwater lake community is likely to result in an increase in the number of marron in the reserve.

Description	Marks
(i) True	1
The heron and bream both eat trout/compete for food	1
(ii) False	1
Trout eat minnows so are the predator to the minnow, not the other way around	1
(iii) False	1
Trout eat minnows and, therefore, if the number of minnows decreased, there would be less food for the trout (which is likely to lead to a decrease in trout numbers, rather than an increase)	1
(iv) True	1
Heron eat/are a predator of marron and, therefore, a reduction in the numbers of this predator would mean fewer marron would be killed (and therefore the number of marron would increase)	1
Total	**/8**

13.   Distinguish between the following terms.

(a)   competition and predation

Description	Marks
Competition occurs when two organisms require the same resource.	1
Predation occurs when one organism captures and feeds on another.	1
Total	**/2**

(b)   parasitism and commensalism

Description	Marks
Parasitism occurs when one organism harms another organism while obtaining nutrients by living on or in the body of that organism.	1
Commensalism occurs when two species share a relationship in which one organism benefits but does not harm the other organism/the other organism is not affected.	1
Total	**/2**

14. Seagrass meadows support diverse communities of organisms. The organisms in the seagrass meadows acquire nutrients in a variety of ways. State whether each of the following organisms is an autotroph, a herbivore, a carnivore, an omnivore or a detritivore. (4 marks)

(a) marine worms that feed on dead pieces of seagrass plants
(b) photosynthetic algae that live attached to the seagrass plants
(c) fish that feed only on other fish
(d) dugongs (sea cows) that eat only seagrass plants

Description		Marks
(a)	detritivore	1
(b)	autotroph	1
(c)	carnivore	1
(d)	herbivore	1
	Total	/4

15. (a) Draw a line graph using all of the data on the grid below.

Description	Marks
The effect of temperature on dissolved oxygen levels	
Title – appropriate title that shows the relationship between the two variables A line graph showing the changes in oxygen solubility as temperature increases	1
Axes labelled correctly with correct units – temperature (^{o}C) and dissolved oxygen (mg/L)	1
Variables on correct axes – horizontal axis temperature (^{o}C) and dissolved oxygen (mg/L) on the vertical axis	1
Correct plotting of data from the table	1
Appropriate scale used	1
Total	/5

(b)   Use your graph to find the:
    (i)   amount of dissolved oxygen present in water of 15°C in mg/L
    (ii)   amount of dissolved oxygen present in water of 25°C in mg/L
    (iii)   temperature at which water would contain 10.20 mg/L of oxygen in °C.

Description	Marks
9.8	1
7.6–7.8	1
13	1
Total	/3

(c)   Explain how an increase in temperature would affect the survival of organisms in a freshwater lake.

Description	Marks
An increase in temperature causes a decrease in the amount of oxygen available for the organisms.	1
This would decrease the survival rate of organisms.	1
Oxygen required for respiration is no longer available.	1
Total	/3

Sample assessment task

Integrated Science – General Year 12

Task 7 – Unit 4

Assessment type: Extended response

Conditions
Period allowed for completion of the task:
       One week for research
       Two 60-minute lessons to create the response

Task weighting
10% of the school mark for this pair of units
_____

Materials used in the manufacture of safety design features in vehicles   **(29 marks)**
Secondary safety design features of vehicles provide increased occupant protection. These include seatbelts, airbags and crumple zones. The materials used in the construction of these features must match the design and purpose of the feature.

Part A – Research phase
1.   (a)   Research and take notes on each of the following safety design features in vehicles –
        seatbelts, airbags and crumple zones. Your research should include the following:
- a definition and description of the safety feature
- an explanation of how it works
- the type of materials from which it is constructed.   (3 marks)

        You may include diagrams in your research.

    (b)   Reference your research using a standard referencing format of your choice; for example, APA, MLA, Harvard or Chicago. Hand this in as a separate sheet attached to your note-taking sheet.   (2 marks)

Part B – Extended response
You will produce a response based on the notes you have researched. This response is to be completed under test conditions. You may use the note-taking sheet as a reference when creating your response.   (24 marks)

Part B

You have been asked to make a presentation on why the materials currently used to make seatbelts, airbags and crumple zones are well suited to their purpose.

Using your notes, discuss the following four points for each of the three safety design features:

(a)   a brief description of each safety design feature   (6 marks)

(b)   a description of how each safety design feature operates to ensure the safety of the occupants
        of the vehicle   (6 marks)

(c)   a description of the material used to construct each safety feature   (3 marks)

(d)   an explanation of why the material used in the construction of each safety design feature
        is well suited to its purpose.   (9 marks)

You may present your response in any format you like. Examples could include a poster, an oral presentation, a slide presentation or pod cast. You may use your notes and your response must be completed by the end of the **two** 60-minute sessions.

Marking key for sample assessment task 7 – Unit 4

Part A

1.   (a)   Research and take notes on each of the following safety design features in vehicles –
seatbelts, airbags and crumple zones. Your research should include the following:
- a definition and description of the safety feature
- an explanation of how it works
- the type of materials from which it is constructed.

Description	Marks
Research presented in a note-taking format	1
Notes are concise and do not include irrelevant information	1
Notes cover all recommended research areas	1
Total	**/3**

(b)   Reference your research using a standard referencing format of your choice; for example,
APA, MLA, Harvard or Chicago. Hand this in as a separate sheet attached to your
note-taking sheet.

Description	Marks
Minimum of four references	1
Correct format used for selected referencing type	1
Total	**/2**

Part B

You have been asked to make a presentation on why the materials currently used to make seatbelts,
airbags and crumple zones are well suited to their purpose.

Using your notes, discuss the following four points for each of the three safety design features:

(a)   a brief description of each safety design feature

Description	Marks
Two marks for the description of each safety design feature	1–6
Answer could include, but is not limited:	

seat belts
- to secure the occupant of a vehicle against harmful movement that may result from a collision or a sudden stop
- consists of a lap belt over the pelvis and a shoulder belt (sash) across the chest, secured to the frame of the car

air bags
- a flexible envelope which inflates rapidly during a collision to prevent occupants from striking interior objects
- the bag consists of a thin nylon fabric, folded into the steering wheel, dashboard, back of seat or door; a crash sensor which tells the bag to inflate, and chemicals which react to produce nitrogen gas

crumple zones
- areas of a vehicle that are designed to deform and crumple in a collision
- front and rear and side impact, design varies, combination of materials or design, strong frame encloses the occupants
- steel and titanium is reinforced with notched metal inserts which cause the metal to crush upwards or downwards to ensure the engine does not move and this keeps the occupants of the vehicle safe

(b) a description of how each safety design feature operates to ensure the safety of the occupants of the vehicle

Description	Marks
Two marks for how each safety design feature operates	1–6
Answer could include, but is not limited:	
seat belts • most of the stopping force is applied to the rib cage and pelvis, not concentrated in one area, so it doesn't do as much damage • the webbing stretches a little bit so the stop isn't so abrupt air bags • when the sensor detects that there is a collision force equal to running into a brick wall at 16–24 km h-1, the airbag's inflation system reacts sodium azide (NaN_3) with potassium nitrate (KNO_3) to produce nitrogen gas (N_2) • N_2 inflates the airbag as it bursts from its storage site. The gas dissipates through tiny holes in the bag so that it deflates • it stops an occupant's momentum with little damage to the occupant crumple zones • the structure of the car gives way during a collision; the car material will dent, bend and fold during collision; extends the time it takes to stop • they reduce the initial force of the crash, and they redistribute the force before it reaches the vehicle's occupants	

(c) a description of the material used to construct each safety feature

Description	Marks
One mark for a description of the material used to make each safety feature	1–3
Answer could include, but is not limited:	
seat belts • synthetic fibres such as nylon, polypropylene or polyester air bags • nylon 6.6 yarn crumple zones • steel or titanium • polymeric foam (high and low density)	

(d) an explanation of why the material used in the construction of each safety design feature is well suited to its purpose

Description	Marks
Three marks for why the material used is well suited to its purpose	1–9
Answer could include, but is not limited:	
seat belts • a moderate amount of stretch in the webbing of the seatbelt extends the stopping distance • nylon is easily woven into webbing, increasing its strength • nylon is durable and long lasting air bags • nylon has high strength • nylon has heat stability so it ages well • nylon has energy-absorbing characteristics and can be coated to make air bags crumple zones • steel and titanium are easily coated with paint • steel and titanium are long lasting/durable • steel and titanium are strong • polymeric foam in the crumple zone has air spaces that absorb the energy from the impact	

Sample assessment task

Integrated Science – General Year 12

Task 11 – Unit 4

Assessment type: Science Inquiry

Conditions
Period allowed for completion of the task: Two weeks

Task weighting
6% of the school mark for this pair of units

_____

Investigation: Factors affecting the severity of collisions (48 marks)

There are many factors which can influence the severity of a vehicle collision and its effects on the people in the car. These include factors such as:
- speed
- road surface – gravel or smooth bitumen, wet or dry
- crash barriers on the sides of roads
- seat belts
- tyres
- crumple zones in cars
- brake efficiency
- air bags
- driver's reaction time.

Task

You are going to **design an investigation** to determine how **one** factor will influence the forces generated by a collision. You can investigate the effects of these forces on the vehicle or on the driver and passengers.

Decide which measurements you will make and how you will process the data in your analysis (do calculations to determine force, acceleration or deceleration).

Preparation

Research how far a car will travel after the driver decides to fully apply the brakes. This is called stopping distance and will depend on the initial speed of the car and other factors like the driver's reaction time, tyres, road surface, vehicle type and loading.

Present your information in a table.

Include **two** sources of your information.

Suggestions

- Use trolleys and ramps to alter the speed of a trolley. Test the effects of increasing speed on plasticine dummies or a barrier.
- Use trolleys and plasticine to model people in vehicles. Create crumple zones, air bags, seat belts or padded dashboards with other materials and conduct crash tests.
- Design your own procedure.

Remember that if you are testing one factor (your independent variable), everything else (such as the mass and speed of the trolley) must be the same. These are your controlled variables.

Use the following *Planning and Report Worksheet for Science Investigations* to assist with writing up your investigation.

Stages of the Investigation

Preparation: Research into stopping distance   **(6 marks)**

Part A – Planning   **(16 marks)**
In your group, plan the investigation and decide which equipment you will need.

Part B – Conducting   **(6 marks)**
Conduct the investigation and collect the data.

Part C– Processing   **(11 marks)**
Record your group's results and process them.

Part D – Evaluating   **(6 marks)**
Evaluate your investigation and suggest how it could be improved.

Part E – Concluding   **(3 marks)**
Write a conclusion for the investigation.

Planning and Report Worksheet for Science Investigations

Student name   _____

Other members of your group   _____

                                                            _____

Part A – Planning   **(16 marks)**

What is the problem you are investigating?

_____

_____

_____

What do you know about this topic from personal experience and from science?

_____

_____

_____

_____

Which variables may affect the phenomenon you are investigating?

_____

_____

Which of the variables are you going to investigate as your independent variable?

_____

How will the independent variable be changed in the experiment?

_____

_____

Name the dependent variable (the variable that responds to changes in the independent variable).

_____

How will you measure the dependent variable?

_____

_____

Which hypothesis are you testing? State your hypothesis as a relationship between the independent and dependent variables.

_____

_____

_____

Which variables are to be controlled (kept constant) to make it a fair test?

_____

_____

List your required equipment.

Draw a labelled diagram of your experimental set-up.

Clearly describe your method.

_____

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Are there any special safety precautions?

_____

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Part B – Conducting (6 marks)

Carry out some preliminary trials. Were there any problems?

_____

_____

How did you modify your experiment to fix the problems?

_____

_____

_____

A data table is used to collect and record the data during the investigation. Draw your data table here.

Title of table: _____

Part C – Processing (11 marks)

What is the best way to process your data? Are there calculations you need to perform?

Use this space to work out any relevant calculations.

Is it appropriate to represent your results in a graph? What type of graph is most suitable? Use the graph paper provided.

Remember to plot the independent variable on the horizontal axis and that the title of the graph should mention both the independent and dependent variables.

Graph title: _____
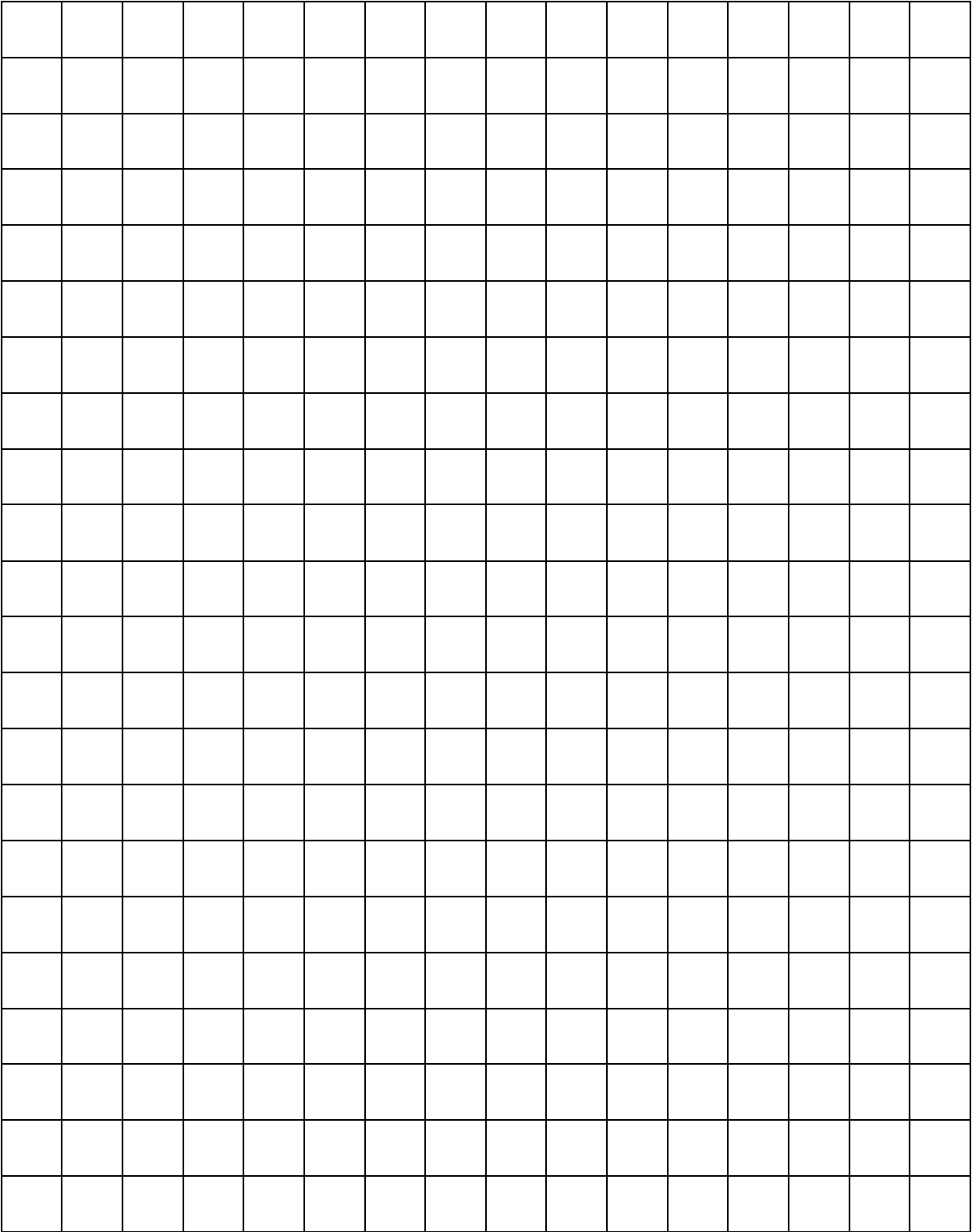
Analyse your data. Are there any patterns or trends in your data? What is the relationship between the variables you have investigated?

_____

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_____

Use science concepts to explain the patterns, trends or relationships you have identified in your data. What is your conclusion?

_____

_____

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_____

_____

_____

Part D – Evaluating (6 marks)

What were the main sources of experimental error?

_____

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_____

_____

How confident are you with your conclusions? How much uncertainty/error is associated with your data?

_____

_____

_____

How could the design of the experiment have been improved to reduce error?

_____

_____

_____

_____

What have you learned about the topic of your investigation? Was the outcome different from your expectation? Explain.

_____

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_____

Part E – Concluding (3 marks)

What is your conclusion? Relate the results back to the hypothesis.

_____

_____

_____

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Does your conclusion support or disprove the hypothesis? Explain.

_____

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_____

_____

_____

Marking key for sample assessment task 11 – Unit 4

Preparation: Research into stopping distance

Research how far a car will travel after the driver decides to fully apply the brakes. This is called stopping distance and will depend on the initial speed of the car and other factors like the driver's reaction time, tyres, road surface, vehicle type and loading.

Present your information in a table.

Include **two** sources of your information.

Description	Marks
Constructs an appropriate table to present the research information • appropriate title • appropriate column headings • columns for each type of factor affecting stopping distance • succinct summary of research	1–4
Includes **two** sources of information	1–2
Total	**/6**

Part A – Planning

Description	Marks
Clearly describes the aim of the investigation	1
Identifies controlled variables	1
Identifies the independent variable	1
Identifies the dependent variable	1
Writes an hypothesis	1
States how controlled variables were controlled	1–2
Lists all materials required	1
Includes quantities	1
Shows a labelled diagram or photograph of equipment set-up	1
Clearly lists the procedure/method to be used	1–5
Lists safety precautions	1
Total	**/16**

Part B – Conducting

Description	Marks
Plans for repeat trials	1–2
Selects appropriate equipment and collects valid results	1–2
Displays data in suitable table	1
Includes a column for averages	1
Total	**/6**

Part C – Processing

Description	Marks
Calculates speed, acceleration or deceleration where appropriate	1–2
Displays data in a suitable graph • title • axes labelled with units • correct plotting of points • suitable type of graph	1–4
Makes a valid statement about trends in the data	1–2
Discusses the relationship between the variables	1
Uses science concepts and terminology to explain the trends	1–2
Total	**/11**

Part D – Evaluating

Description	Marks
Discusses sources of error in the investigation	1–2
Discusses uncertainty in the investigation	1–2
Makes reasonable suggestions for improvements to procedure	1–2
Total	**/6**

Part E – Concluding

Description	Marks
Writes a conclusion and relates it to the hypothesis	1–2
Identifies if the hypothesis has been supported or disproved by the data	1
Total	**/3**