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

SAMPLE ASSESSMENT TASKS

EARTH AND ENVIRONMENTAL SCIENCE
GENERAL YEAR 11

Sample assessment task

Earth and Environmental Science – General Year 11

Task 1 – Unit 1

Assessment type: Extended task

Conditions
Time for the task: two lessons for planning and building the seismograph
one lesson for testing the seismograph
one lesson to write report

Task weighting
8% of the school mark for Units 1 and 2

Task 1: Construct a seismograph **(40 marks)**

Major earthquakes around the world cause death and devastation due to landslides, building collapse and tsunamis. In cities, flooding and fires are also caused when water pipes, sewerage pipes and gas mains burst. Scientists are able to measure the strength of earthquakes using seismographs.

Class discussion (8 marks)

- How do scientists measure earthquakes?
- Why do we need to measure earthquakes?
- How are tsunamis formed and why do we need warnings about them?
- Record your responses to the class discussion and describe the activity and aims of the task.

Two lessons to complete the task in class (10 marks)

- In your group, plan and construct a model seismograph.
- Describe how you made the model.
- Submit a labelled diagram of your design, showing its features and note any modifications you made to your teacher.
- Negotiate a time with your teacher to demonstrate your model and explain its use to the class.

One lesson to demonstrate your seismograph (11 marks)

- Test your seismograph by dropping a ball onto the desk from different heights (e.g. 0.5m, 1m and 1.5m). Your seismograph needs to record a reading for all three heights. Repeat three times for each height. Record the testing process
- Record the results of these tests. The seismograph that is most sensitive for all tests will be considered the best in the class.

One lesson to write your report (11 marks)

- Include a labelled diagram or labelled photograph of your seismograph.
- Describe the design features of your seismograph and explain why each of them was included.
- Describe your results for the demonstration test.
- Were there any limitations to your design? How could it have been improved?
- How is your seismograph different to the ones in earthquake early-warning centres?
- List the references you used for your research.

Marking key for sample assessment task 1 – Unit 1

Construct a seismograph

Description	Marks
Background	**/8**
Introductory statements and activity aims	1–2
Background on classroom discussion topics	
• How do scientists measure earthquakes?	1–2
• Why do we need to measure earthquakes?	1–2
• How are tsunamis formed and why do we need warnings about them?	1–2
Planning and constructing	**/10**
Diagram clearly shows the structure of the seismograph	1–2
Clearly describes making the device	1–2
Describes design features	1–3
Explains why design features were included	1–3
Testing	**/11**
Clearly describes the procedure to be used for testing	1–3
Shows a diagram or photograph of equipment set-up	1–2
Collects accurate results	1–2
Displays data in suitable format	1–2
Performs repeat trials	1–2
Processing and analysis	**/4**
Makes a valid statement about the data collected	1–2
Makes reasonable suggestions for improvements to device and/or testing procedure	1–2
Communication	**/7**
Uses appropriate scientific terminology	1–2
Compares made seismograph with professional ones: different stability measures, sensitivities	1–3
Records references for research	1–2
Total	**/40**

Sample assessment task

Earth and Environmental Science – General Year 11

Task 5 – Unit 1

Assessment type: Investigation

Conditions
Time for the task: one class for planning
one class for conducting
25 minutes for in-class validation test

Task weighting
8% of the school mark for Units 1 and 2

Task 5: Investigation of soil wettability **(40 marks)**

Many soils in Western Australia are 'non-wetting', which means that water that is applied to the soil is unable to penetrate, and therefore is not made available for plant uptake.

You are to work in groups of two or three students to design and conduct an investigation into this issue. You can compare the wettability of different soils, or test the effect of applying soil wetting agents to soil.

Class discussion
- What is soil wettability?
- How can we measure the wettability of soil?
- How do soil wetting agents work?

Planning **(8 marks)**
As a group, decide which question you are going to investigate and write a hypothesis that relates the dependent and independent variables. Identify **three (3)** variables that you will control.

Plan the equipment you will need and the measurements you will make. Include replicates (repeat trials).

Conducting **(10 marks)**
Write your procedure in a step-by-step list in sufficient detail that someone else could conduct your experiment.

Include a labelled diagram of your equipment set-up or label a photograph of your equipment.

Record all your results in a suitable table.

Processing and analysis **(6 marks)**
Discuss your results, including trends noted in your data, and make a conclusion. Relate your conclusion to your hypothesis.

Discuss the limitations of your investigation and make suggestions for improvements.

Prepare for the in-class validation test on this investigation.

In-class validation of soil wettability investigation **(16 marks)**

1. Describe in detail how you measured the wettability of your soil. (5 marks)

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2. (a) List **three (3)** variables that you controlled in your investigation. (3 marks)

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(b) What is your independent variable? (1 mark)

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(c) What is your dependent variable? (1 mark)

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3. What did you learn about soil wettability from your investigation? (2 marks)
Discuss your conclusion.

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4. Why is soil wettability important to gardeners? (2 marks)

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5. Describe two ways that you could improve your investigation to obtain more accurate results. (2 marks)

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Marking key for sample assessment task 5 – Unit 1

Description	Marks
Planning	**/8**
Develops a clear hypothesis which relates the variables	1–2
Lists all materials	1–2
States how controlled variables were controlled e.g. mass of soil, amount of water added, amount of soil wetter added	1–3
Plans for repeat trials	1
Conducting	**/10**
Clearly lists the procedure to be used: • weigh or measure soil samples • measure added water (and wetting agent if used) • how to measure water absorbed	1–3
Shows a diagram of equipment set-up	1–2
Selects appropriate equipment and collects accurate results	1–2
Displays data in suitable format	1–2
Averages data from repeat trials	1
Processing and analysis	**/6**
Makes a valid statement about trends in the data	1–2
States conclusion and relates it to the hypothesis	1–2
Makes reasonable suggestions for improvements to procedure	1–2
In-class validation questions	**/16**
1. Clear, logical description of how the measurements for wettability were taken, and any calculations conducted: • measure initial mass of soil sample • add a measured volume of water • measure mass of wet soil or volume of water that was not absorbed • calculate amount of water absorbed by samples • average the results from repeat trials	1–5
2. (a) Lists three controlled variables	1–3
(b) Correctly names independent variable	1
(c) Correctly names dependent variable	1
3. Clearly describes the conclusion	1–2
4. Describes the ability of soils to allow water to penetrate so it is available for plants	1–2
5. Describes two appropriate measures for improving the procedure	1–2
Total	**/40**

Sample assessment task

Earth and Environmental Science – General Year 11

Task 7 – Unit 2

Assessment type: Investigation

Time for the task (4 weeks)
- two weeks to collect data using field techniques
- two weeks, including time outside class, to collate and analyse results and write report

Task weighting
10% of the school mark for Units 1 and 2

Task 7: Field investigation of an ecosystem **(34 marks)**
Investigate a local area to study the organisms present and their relationship to their environment. Present your findings in a scientific report.

What you need to do

1. **Plan the investigation**
   - Make a preliminary visit to the site
   - Select an area to study
   - Take photographs and make notes of the location
   - Describe the equipment and methods you will use

2. **Conduct the investigation and record results**
   - Overview of the site being investigated
   - Show the location of your study area with diagrams and maps
   - Prepare tables to record your observations
   - List organisms observed in the selected area (look for all levels in the food web)
   - Look for evidence of other organisms e.g. scats, prints, diggings
   - Record the abiotic aspects of the environment e.g. soil type, temperatures, shade, water
   - Research two organisms that you have found and determine their habitat and nutritional requirements

3. **Process your results**
   - Use keys to classify organisms e.g. arthropods to family level
   - List all organisms in groups according to their classification and record relevant data such as habitat and conditions
   - Draw a food web for this community
   - Describe the relationships between the biotic and abiotic aspects of the environment

4. **Communicate your findings** – Prepare a scientific report of your findings. Include:
   - Introduction (purpose, planning, maps) (6 marks)
   - Materials and method (4 marks)
   - Results (observations, classification of organisms, food web, relationship between biotic and abiotic factors) (20 marks)
   - Conclusion: Discuss how the environment provides the conditions necessary for at least two organisms in the ecosystem (4 marks)

Marking key for sample assessment task 7 – Unit 2

Field investigation of an ecosystem

Description	Marks
Introduction	**/6**
Clearly identifies the purpose of the study	2
Identifies the purpose of the study	1
Presents well-drawn, clearly labelled maps to show the location of the study	3–4
Presents sketch maps to show the location of the study	1–2
Materials and method	**/4**
Lists the materials required for the study	1–2
Clearly describes the methods used to observe a variety of organisms	2
Identifies methods used to observe organisms	1
Results	**/20**
Lists and classifies a wide range of organisms including producers and consumers at different levels	4
Lists and classifies a range of organisms including producers and consumers at different levels	3
Lists and classifies a range of organisms, but does not include all levels	2
Lists organisms	1
Draws an accurate food web for the community, containing a number of organisms at each level, including decomposers	4
Draws an accurate food web for the community, containing a number of organisms at each level	3
Draws a food web for the community, containing some organisms at each level	2
Draws a simple food web for the community	1
Describes habitat and nutritional requirements for two organisms	1–4
Describes abiotic factors – shade, soil, rocks, temperature, water	1–4
Relates abiotic factors to occurrence for at least two different organisms Describes where organisms occur, relates the population of organisms to presence of food and shelter and other requirements of the organism e.g. damp, shady conditions with dead plant matter for food are where slaters occur	1–4
Conclusion	**/4**
Describes the community and relates its components to the environmental conditions	3–4
Briefly describes the community	1–2
Total	**/34**

Sample assessment task

Earth and Environmental Science – General Year 11

Task 11 – Unit 2

Assessment type: Test

Conditions
Time for the task: 50 minutes

Task weighting
10% of the mark for Units 1and 2

Test: Biogeochemical cycles, water cycle, water resources, land use

Student name _____ **Total: 45 marks**

Question 1
NASA has recently pledged to land an astronaut on Mars by 2035. When scientists are planning a manned mission to Mars, they need to be able to provide food, water and oxygen for the passengers on the spacecraft for the long trip. The round trip to Mars will take more than two years. Growing plants in the spacecraft is seen as an important way to cycle carbon through the system.

(a) How could growing tomato plants improve the air quality in the spacecraft? (2 marks)

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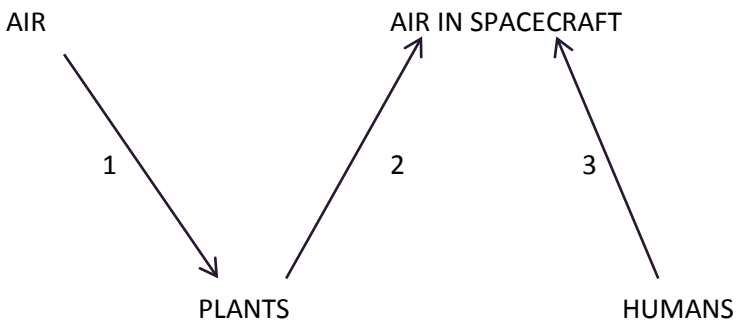
(b) The arrows in the diagram below indicate the transfer of carbon between the air, the plants and the humans in the spacecraft. Label the **three (3)** processes involved. (3 marks)



1. _____
2. _____
3. _____

Question 2

For many decades, farmers in WA were encouraged by the government to clear native vegetation from their land and to plant crops and pasture. More recently, it has been recognised that this policy of land clearing has had disastrous effects on the environment.

(a) Describe **three (3)** ways the long-term clearing of land for agriculture has affected water resources in Western Australia. (3 marks)

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(b) Describe **four (4)** ways the clearing of land for agriculture has had a damaging effect on soils in Western Australia. (4 marks)

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(c) Describe how the clearing of land for agriculture has affected biodiversity in Western Australia. (3 marks)

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(d) Farmers discovered that their crops grew better if they applied nitrogen-rich fertilisers to the soil. Describe the effects that this practice could have on the health of nearby waterways. (3 marks)

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(e) Describe the measures that could be used to lessen these effects (from part d) on the waterways. (3 marks)

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Question 3

Western Australia's population is increasing rapidly and this has led scientists to say that 'the rate at which water is being used in Perth is unsustainable'.

(a) Explain what this statement means. (2 marks)

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(b) Name **three (3)** strategies that the government of Western Australia may use to supply water to the population. (3 marks)

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(c) What is meant by the term 'aquifer'? (2 marks)

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Question 4

(a) Draw a diagram showing how water cycles at a freshwater lake ecosystem. Label at least **three (3)** locations and **three (3)** processes involved in the water cycle. (6 marks)

(b) If many people living near the lake install bores to supply groundwater for their gardens, how could this impact on the ecosystem of the lake. Describe **three (3)** possible effects. (3 marks)

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Question 5

Bacteria are involved in the nitrogen cycle by changing nitrogen from one form to another. Describe **two (2)** functions that bacteria perform to transform nitrogen from one form to another.

(4 marks)

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Question 6

Scientists are keen to know whether life exists or has ever existed on the planet Mars. They can look at meteorites which have been ejected from Mars and landed on Earth. These are judged to be from Mars because of their similar composition to isotopes of argon in the Martian atmosphere, or to rocks on Mars that have been analysed by the Mars Rover. Some meteorites show evidence of water, and others show signs of fossilised microorganisms.

(a) Why are scientists excited about these finds? (2 marks)

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(b) Outline the assumptions that the scientists make about these meteorites in order to infer information about conditions on Mars. (2 marks)

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Marking key for sample assessment task 11 – Unit 2

Test: Biogeochemical cycles, water cycle, water resources, land use

1 (a) How could growing tomato plants improve the air quality in the spacecraft?
(b) The arrows in the diagram indicate the transfer of carbon between the air, the plants and the humans in the spacecraft. Label the three processes involved in this transfer.

Description	Marks
(a)	
Absorb carbon dioxide	1
Produce oxygen	1
(b)	
1. Photosynthesis	1
2. Respiration	1
3. Respiration	1
Total	**/5**

2 (a) Describe **three (3)** ways the long-term clearing of land for agriculture has affected water resources in Western Australia.
(b) Describe **four (4)** ways the clearing of land for agriculture has had a damaging effect on soils in Western Australia.
(c) Describe how the clearing of land for agriculture has affected biodiversity in Western Australia.
(d) Farmers discovered that their crops grew better if they applied nitrogen-rich fertilisers to the soil. Describe the effects that this practice could have on the health of nearby waterways.
(e) Describe the measures that can be used to lessen these effects (from part d) on the waterways.

Description	Marks
(a) Water table has risen	1
Salt is brought to surface	1
Fresh water turns salty	1
(b) Topsoil is no longer protected	1
Topsoil blows away	1
Nutrients are lost	1
Soil is contaminated by salt brought to the surface by rising water table	1
(c) Any three of the following: Clearing destroys habitat	1–3
Clearing reduces food supply for animals	
Clearing native vegetation decreases number of plant species present	
Diversity of animal species is reduced	
(d) Nitrates washed into waterway increase nutrients in waterway	1
Can cause algal blooms which decrease amount of oxygen in water	1
Can kill fish etc. through eutrophication	1
(e) Use slow-release fertiliser	1
Use less fertiliser	1
Don't apply fertiliser when it is going to rain	1
Total	**/16**

3. (a) Explain what this statement means.

(b) Name **three (3)** strategies that the government of WA may use to supply water to the population.

(c) What is meant by the term 'aquifer'?

Description	Marks
(a) Water is being extracted faster than it can be naturally replaced	1
The water supply will become insufficient for Perth	1
(b) Storage dams	1
Groundwater from aquifers	1
Desalination	1
(c) A permeable layer of rock	1
Contains water	1
Total	**/7**

4. (a) Draw a diagram showing how water cycles at a freshwater lake ecosystem. Label at least three locations and three processes involved in the water cycle.

(b) If many people living near the lake install bores to supply groundwater for their gardens, how could this impact on the ecosystem of the lake. Describe three possible effects.

Description	Marks
(a) Locations include lake, clouds, atmosphere, plants (maximum three)	1–3
Processes must relate to correct arrow: transpiration, evaporation, precipitation/rain, surface runoff, infiltration (maximum three)	1–3
(b) Water level in lake goes down	1–3
Water plants die and surrounding ecosystem is adversely affected	
Water animals lack food/habitat	
Decomposition of plants poisons water/decreases oxygen level in water	
Organisms die	
Total	**/9**

5. Bacteria are involved in the nitrogen cycle by changing nitrogen from one form to another. Describe two functions that bacteria perform to transform nitrogen from one form to another.

Description	Marks
Nitrogen fixing bacteria Remove nitrogen from air to soil	1 1
Decomposing bacteria Release nitrogen from organic matter into the soil for conversion by nitrifying bacteria	1 1
OR Nitrifying bacteria Change ammonia to nitrate for plant uptake (Maximum of two bacteria types)	
Total	**/4**

6. (a) Why are scientists excited about these finds?

(b) Outline the assumptions that the scientists make about these meteorites in order to infer information about conditions on Mars?

Description	Marks
(a) The presence of water implies that there could have been life as we know it on Mars	1
Microorganisms are a form of life that could have existed on Mars	1
(b) They assume that if the rock's composition is similar to Mars, the meteorite is from Mars	1
If the isotopic composition is similar to rocks found on Mars, it is also from Mars	1
Total	**/4**