

STUDENT NUMBER: \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

STUDENT NAME: \_\_\_\_\_ CLASS: \_\_\_\_\_



ENVIRONMENT  
EDUCATION  
VICTORIA

## Victorian Certificate of Education 2021 ENVIRONMENTAL SCIENCE

### Trial Written Examination

Reading time: 15 minutes

Writing time: 2 hours

### QUESTION AND ANSWER BOOK

#### Structure of book

<i>Section</i>	<i>Number of Questions</i>	<i>Number of Questions to be answered</i>	<i>Number of Marks</i>
A	30	30	30
B	9	9	90
			Total 120

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers and one scientific calculator.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

#### Materials supplied

- Question and answer book of 32 pages
- Answer sheet for multiple-choice questions

#### Instructions

- Write your **student number, name** and **class** in the space provided above on this page.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
- All written responses must be in English.

#### At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room**

Reviewed by: Dr Maddy Yewers [MSci, PhD - Ecology and Evolutionary Biology]

Please note this is a practice exam only and its degree of hardship and content is different to the end of year exam.  
EEV takes no responsibility for your success in completing the actual VCE Environmental Science exam.

**Section A - Multiple Choice Questions****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Total marks for this section: **30 marks**

**Question 1**

Which of the following is **not** an accepted criteria for a mass extinction event?

- A. The event must have occurred in a relatively short time frame
- B. The extinction involves multiple lifeforms and is widespread
- C. A significant part of life on Earth became extinct
- D. The cause of the mass extinction must be obvious

**Question 2**

Which of the following events resulted in the most species extinctions overall?

- A. Ordovician-Silurian
- B. Cretaceous-Tertiary
- C. End Permian
- D. End Triassic

**Question 3**

Which of the following best describes the distribution and variety of DNA and inherited traits amongst a population of organisms?

- A. Genetic abundance
- B. Species abundance
- C. Genetic diversity
- D. Species diversity

Use the following information to answer Questions 4 and 5.

The water hyacinth (*Eichhornia crassipes*) is a floating waterlily-type freshwater aquatic plant. This plant was introduced to Australia in the early 1900s as an ornamental plant for ponds and is now one of the world's worst weeds, causing environmental damage to lakes and rivers in QLD and NSW.

The water hyacinth has the ability to bio-magnify a high concentration of heavy metals (such as mercury and lead) in its leaf tissues without suffering damage to the actual plant. Some studies have suggested growing large numbers of water hyacinth in lakes that are contaminated by mercury will improve the condition of the water in the lakes.

#### Question 4

Which of the following ecosystem services is achieved by growing water hyacinth in mercury-contaminated lakes?

- A. Nutrient cycling
- B. Climate control
- C. Soil formation
- D. Water purification

#### Question 5

Which of the following explains how water hyacinth could harm the local lake environments?

- A. Take nutrients and resources from native fish species
- B. Change the genetic makeup of native fish species
- C. Decrease the oxygen in the lake for local fish
- D. Contribute to the overfishing problem by trapping local fish species

#### Question 6

The Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) is the smallest of the rhinoceros species. Populations of this animal can be found in tropical rainforests on the Indonesian islands of Sumatra and Borneo. It is estimated that fewer than 80 individuals remain in highly fragmented populations on these islands. In the past 15 years, just two captive females have produced offspring.

According to the IUCN, which of the following is the most likely conservation category for the Sumatran Rhinoceros?

- A. Extinct in the wild
- B. Critically endangered
- C. Endangered
- D. Highly threatened

**Question 7**

Which of the following is true of genetic drift?

- A. It is a result of natural selection
- B. It only occurs in large populations
- C. It happens as a result of a large increase in population size
- D. It is a chance loss of an allele from a population

**Question 8**

Biodiversity changes may happen naturally, due to natural selection, brought on by the isolation of populations.

Which of the following describes a short-timescale, natural occurrence that may lead to population isolation?

- A. El Niño
- B. Bushfire
- C. New housing developments
- D. Tectonic movements

Use the following information to answer Questions 9–11.

Christmas Island is an Australian territory island, found approximately 350km south of the Indonesian islands of Java and Sumatra. Huge populations of red crabs inhabit burrows and rock crevasses in the tropical rainforest that covers much of the island. The crustaceans migrate from the rainforest to the shoreline for breeding once a year at the beginning of the wet season.

Although more than half of Christmas Island is dedicated as a national park, the island is still home to a population of around 2000 people. During the migration, the crabs must navigate roads, predatory birds and ants, and backyard pets to make it safely to the sea to spawn.



Source: <https://parksaustralia.gov.au/christmas/discover/highlights/red-crab-migration/>

As a measure in the protection and maintenance of the red crab population, ‘crab bridges’ (see image above) have been built over some roads to allow the crabs to cross without the danger of traffic. The ‘crab bridges’ are aided by roadside barriers to stop the crabs crossing the busy roads away from the bridge.

### Question 9

The ‘crab bridges’ act as a strategy in the protection and maintenance of the biodiversity on Christmas Island.

Which of the following best describes ‘crab bridges’?

- A. Wildlife corridor
- B. Translocation zone
- C. Conservation bridge
- D. Habitat regeneration zone

### Question 10

The Christmas Island Tourism Association has used the bridges as part of their tourism marketing campaign to attract visitors to come to the island to view the migration.

Which of the following best describes this approach?

- A. Ecocentric
- B. Anthropocentric
- C. Biocentric
- D. Species-centric

**Question 11**

As part of a wildlife study, an environmental science student has suggested collecting data of the air temperature on the first day of the crab migration over a series of 5 years. She has also suggested comparing the values of air temperature to the number of crabs that successfully cross one particular bridge, to arrive at the sea, in that year. The purpose of her study is to try and determine if there is a correlation between air temperature and the number of crabs that successfully arrive at the sea in one particular area of the island.

Which of the following is ***not*** an appropriate ethical or safety guideline specific to this field investigation?

- A. The environmental scientist must wear personal sun protection equipment when collecting data
- B. The environmental scientist must take all measures possible to not disturb the natural movement of the crabs when collecting data
- C. The environmental scientist must take all precautions in minimising the miscounting of crabs as they pass the end of the bridge
- D. The environmental scientist must ensure all members of her data collection team display appropriate behaviour when in and around the water's edge

*Use the following information to answer Questions 12 and 13.*

Christmas Island is also home to the critically endangered Christmas Island flying fox. Roughly a quarter of Christmas Island Flying-fox habitat has been lost since the late 1880s due to mining and other developments on Christmas Island. Other threats include predation by feral cats, poisoning from environmental contaminants and physical disturbance and habitat change caused by Yellow Crazy Ants.

**Question 12**

To estimate the size of the flying fox population on Christmas Island, conservationists used the mark-recapture method. On the first night session of sampling they captured, marked and released 312 individuals. A week later they captured 625 flying foxes, of which 75 had been marked.

Which of the following is the best estimate of the size of the Christmas Island flying fox population?

- A. 38
- B. 150
- C. 1300
- D. 2600

**Question 13**

The Christmas Island flying fox is endemic to Christmas Island.

Which of the following best describes the term ‘endemic’ in this context?

- A. Conservation management techniques being applied are vitally important to conserve the species
- B. The population of flying foxes is at risk of extinction
- C. The population of flying foxes are only found on Christmas Island
- D. Christmas Island is a biodiversity hotspot

**Question 14**

Which one of the following is considered a fossil fuel?

- A. Nuclear energy
- B. Hydroelectricity
- C. Geothermal energy
- D. Natural gas

**Question 15**

Which of the following statements is the most correct regarding the Global Warming Potential of atmospheric gases?

- A. It is a measurement of the gases absorption capability of infrared radiation
- B. It is a measurement of the atmospheric lifetime of the gas
- C. It is measured relative to 1 ton of CO<sub>2</sub> emissions
- D. It is a measurement of climate change

**Question 16**

Iceland is one of very few countries that currently provides its citizens with electricity produced from 100% (or very close to 100%) renewable energy.

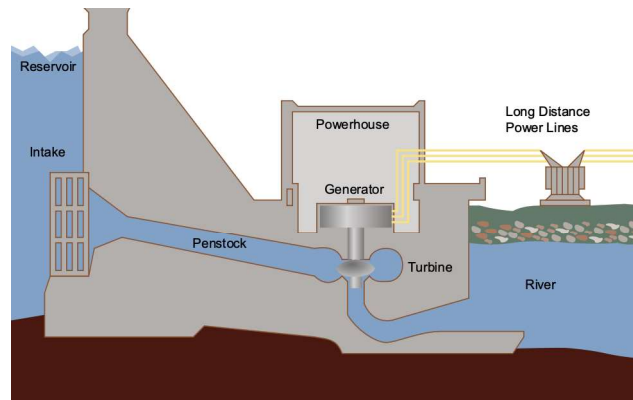
A leader in fighting climate change, Icelandic energy companies also undertake a process in which CO<sub>2</sub> is removed from the atmosphere, dissolved in H<sub>2</sub>O and injected into basalt rock at around 500m below the surface.

Which of the following best describes this process?

- A. The hydrogen cycle
- B. Carbon sequestration
- C. Short term carbon storage
- D. Acceleration of the carbon cycle

Use the following information to answer Questions 17 and 18.

The image below shows a hydroelectric power station



Source: Tennessee Valley Authority; SVG version by Tomia, CC BY-SA 3.0 <http://creativecommons.org/licenses/by-sa/3.0/> via Wikimedia Commons

### Question 17

What type of energy does the water in the turbine represent?

- A. Potential
- B. Chemical
- C. Kinetic
- D. Electric

### Question 18

The turbine is able to convert 1500 KJ of mechanical energy into 1000 KJ of electrical energy every second.

What is the percentage efficiency of the water turbine?

- A. 5%
- B. 25%
- C. 67%
- D. 150%

### Question 19

The production of hydrogen powered cars is predicted to increase in the coming years as part of the Australian government's strategy to lower carbon emissions.

Which of the following is a major environmental advantage of hydrogen gas as a fuel source?

- A. It can be easily extracted from the atmosphere
- B. No CO<sub>2</sub> is emitted in the burning process
- C. It is easier than petrol to store in a car
- D. Bulk transportation is easier than bulk transportation of petrol



**Question 20**

The Ranger Uranium Mine is 230km east of Darwin. It is an open-cut uranium oxide ( $U_3O_8$ ) mine, within Kakadu National Park, traditionally owned by the Bininj people.

The mine ceased functioning in January of this year and the rehabilitation process has begun.

Which of the following is ***not*** a description of a mechanical rehabilitation strategy for the Ranger Uranium Mine?

- A. Replacing rock and soil to cover in the crater or pit
- B. Replanting of plant species native to the site
- C. Dredging mud from the water storage dams
- D. Demolition of the buildings and infrastructure

**Question 21**

Which of the following activities contributes the most to carbon emissions globally?

- A. Agriculture
- B. Transport
- C. Forestry
- D. Energy supply

**Question 22**

The Paris Agreement is a legally binding international treaty on climate change. Its goal is to limit global temperature rise to 2 degrees Celsius.

Which of the following is true if this goal is to be met?

- A. All nations need to stop burning fossil fuels by 2100
- B. All nations need to stop burning fossil fuels by 2040
- C. Fossil fuel burning is irrelevant, the Sun will cool and so will the Earth
- D. It's already too late to meet this goal, as the burning fossil fuels should have stopped in the early 2000s

**Question 23**

Which of the following causes the greenhouse effect?

- A. Greenhouse gases in the lower atmosphere absorbing incoming solar radiation
- B. Greenhouse gases in the lower atmosphere absorbing incoming and re-radiated solar radiation from the Earth's surface
- C. Too much heat in the atmosphere
- D. Too much sunshine reaching Earth

**Question 24**

Which of these natural events affect Earth's climate?

- A. Thawing permafrost
- B. The path of the Earth around the sun
- C. Volcanic eruptions
- D. All of the above

**Question 25**

Which of these greenhouse gases is most abundant in the atmosphere?

- A. Carbon dioxide
- B. Methane
- C. Nitrous oxide
- D. Water vapour

**Question 26**

Most types of coral gain their bright colours due to a symbiotic relationship with photosynthetic marine algae called Zooxanthellae. The algae avoid predators by living inside the coral. The coral gain food as well as their bright colours from the algae. Coral bleaching is a problem that arises when the coral rejects the algae; as a result, they lose their food source as well as their bright colours.

What is the leading cause of this bleaching process?

- A. CO<sub>2</sub> dissolved in ocean water
- B. Microplastic pollution
- C. Increased water temperature
- D. Sediment stirred up by extreme storms

*Use the following information to answer Questions 27 and 28.*

A local council is considering plans to develop a 245 hectare stretch of land in a coastal suburb in south-west Victoria. The land is currently dedicated as natural parkland; and is appreciated for its environmental and biodiversity values as well as its Aboriginal cultural heritage.

A group of local residents have been especially vocal and active in their views on the importance of this area. Several threatened species are thought to use the creek and woodland area as habitat, but additional fieldwork is necessary to collect more data to confirm this.

The local council has proposed three options for the use of this land:

- **Option 1** - Do not proceed with the development plan
- **Option 2** - Create a neighbourhood estate, with medium density housing blocks, a school and small shopping center.
- **Option 3** - Create a protected area within the land to be managed by Parks Victoria. This area will contain a creek zone and a population of the endangered Bellarine Yellow Gum (*Eucalyptus leucoxydon*) trees. Designate the remainder of the land as “rural zone”, to be left as-is for the immediate future. This option incurs a significantly higher cost than Option 2.

#### **Question 27**

The local council has decided to accept Option 1.

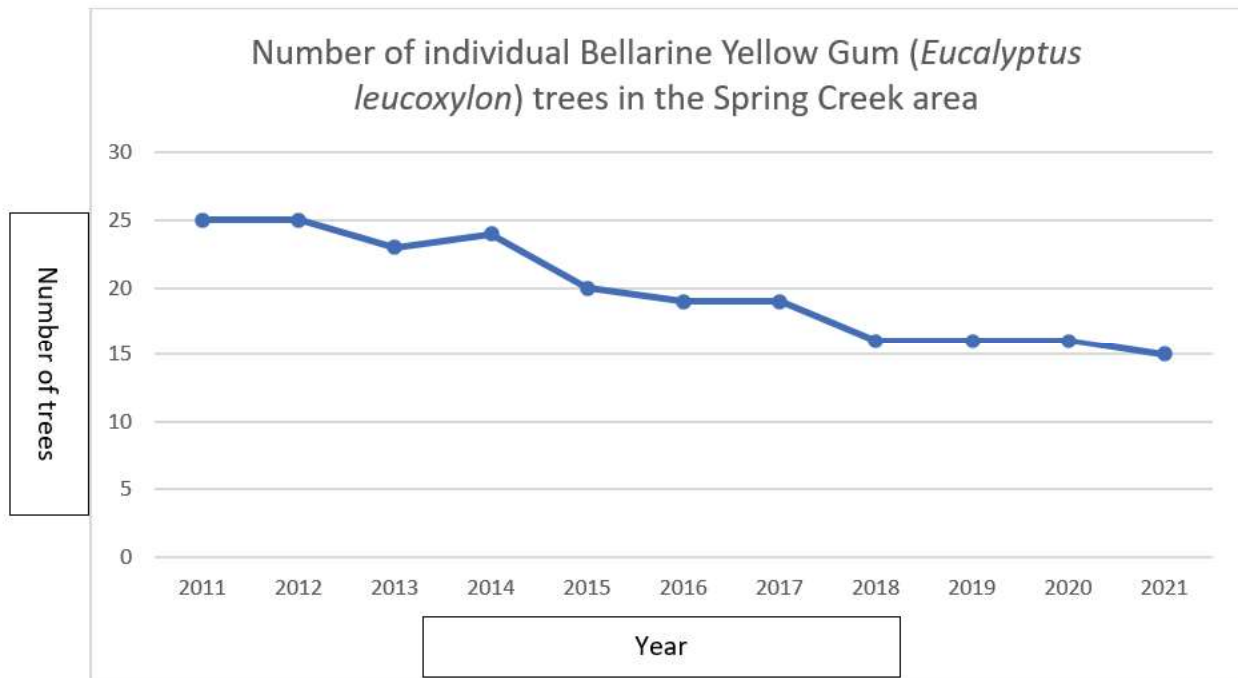
Which of the following would be the most likely basis for their decision?

- A. The precautionary principle
- B. The user-pays principle
- C. Intragenerational equity issues
- D. Economic sustainability unease

**Question 28**

The Bellarine Yellow Gum (*Eucalyptus leucoxylon*) is one of many threatened species thought to be found in this area of Victoria.

Local council conservation scientists have been studying the population in this area for the past ten years. The figure below shows their data.



What was the percentage reduction in this population of trees from 2011 until 2021?

- A. 10%
- B. 15%
- C. 40%
- D. 60%

Use the following information to answer Questions 29 and 30.

An environmental scientist is studying the interactions of salt, ice and water as part of her study of climate change in Antarctica. Her aim is to test how salt affects the freezing point of water. She does this by following the method below.

1. Set up 5 beakers with 250ml of tap water (label beakers A to E).
2. Do not add salt to beaker A.
3. Add 3 grams of salt to beaker B.
4. Add 6 grams of salt to beaker C.
5. Add 9 grams of salt to beaker D.
6. Add 12 grams of salt to beaker E.
7. Place all beakers into a freezer. Reduce the temperature of the freezer by 1°C every minute and record the temperature when the water in the beaker freezes.

Her data is recorded below.

Beaker	A	B	C	D	E
Freezing point (°C)	0	-2	-4	-7	-8.5

### Question 29

Which of the following is an appropriate conclusion based on the above data?

- A. Salt has no effect on the freezing point of water
- B. Salt increases the freezing point of water
- C. Salt decreases the freezing point of water
- D. Salt affects the freezing point of ice water but not tap water

### Question 30

What was the independent variable for this experiment?

- A. Grams of salt
- B. Beaker number
- C. Temperature of freezing point
- D. Millilitres (ml) of tap water

## SECTION B – Short Answer Questions

## Instructions for Section B

Answer **all** questions in the spaces provided. Write using **blue or black pen**.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Total marks for this section: **90 marks**

## Question 1 (12 marks)

A group of scientists have been surveying two local regions of bushland, one of which is a high traffic area for sightseers and bushwalkers. Boneseed is a noxious introduced weed originally from South Africa. It is an evergreen woody shrub and can invade the understory of native forests and bushland. It competes with native plants, and dense infestations can be a significant fire hazard. It is spread by seed only and germination is promoted by fire, soil disturbance, weathering and ingestion of seeds by animals.

A survey was taken of some of the local plant species, and the results are shown in the tables below.

The index (D) can be calculated as follows.

$$\text{Simpson's Index: } D = 1 - \frac{\sum[n_i(n_i-1)]}{N(N-1)}$$

Note:  $\Sigma$  refers to the 'sum of'

$n_i$  means the total number of organisms of each individual species

$N$  means the total number of organisms of all species

A higher index value indicates greater species diversity.

<i>Species recorded at site A</i>	$n_i$	$n_i - 1$	$n_i(n_i - 1)$
Prickly tea-tree	9	$9 - 1 = 8$	$9 \times 8 = 72$
Rock correa	12	$12 - 1 = 11$	$12 \times 11 = 121$
Myrtle wattle	8	$8 - 1 = 7$	$7 \times 8 = 56$
Manna gum	7	$7 - 1 = 6$	$7 \times 6 = 42$
Silver banksia	9	$9 - 1 = 8$	$9 \times 8 = 72$
Boneseed	5	$5 - 1 = 4$	$5 \times 4 = 20$
$N$	50		$\Sigma[n_i(n_i - 1)] = 383$
$N(N - 1)$	2450		

$$\text{Simpson's index: } D = 1 - \frac{\sum[n_i(n_i-1)]}{N(N-1)}$$

$$D = 1 - \frac{383}{2450} = 0.844$$

Simpson's Index (D) for site A is 0.844

a. Use the figures in the table below and the spaces provided to calculate Simpson’s Index (D) for Site B.

3 marks

<i>Species recorded at site B</i>	$n_i$	$n_i - 1$	$n_i(n_i - 1)$
Prickly tea-tree	6		
Rock correa	5		
Myrtle wattle	5		
Manna gum	2		
Silver banksia	3		
Boneseed	15		
$N$			$\Sigma[n_i(n_i - 1)] =$
$N(N - 1)$			

Simpson's index:  $D = 1 - \frac{\Sigma[n_i(n_i-1)]}{N(N-1)}$

$D = 1 - \text{—————}$

$D =$

Simpson’s Index (D) for site B is

b. Which site (A or B) has the higher species diversity? Explain and justify your answer using the Simpson’s Index values.

2 marks

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**c.** Describe the sampling technique that would have been used to collect this plant data. 2 marks

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**d.** Compare the species richness and the ecological integrity at each of the two sites. 2 marks

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**e.** Describe the impact that the boneseed can have on the native ecosystem, and suggest a management strategy that can be employed to control the spread of the species. 3 marks

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**Question 2 (8 marks)**

A species of ground dwelling orchid, *Pterostylis truncata* (Brittle Greenhood), is listed as endangered under the *Victorian Flora and Fauna Guarantee Act (1998)*.

Once reported to be found in nine different locations, the Brittle Greenhood is now known only to survive in 3 locations, with remaining populations found on both private and public land.

The orchid is known to occur in habitats ranging from grasslands to woodlands, and in a variety of soils. The orchid's disappearance can be attributed to the impact of feral goats, road maintenance, European rabbits, competition from Boneseed, trampling by enthusiasts and weed invasion.

- a. What is the benefit of the orchid being listed under the *Victorian Flora and Fauna Guarantee Act*? 1 mark

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- b. It is possible that conservation techniques may not be successful, and the species numbers may continue to decrease in the coming years. If this were to be the case, state the new conservation category that the Brittle Greenhood could occupy. 1 mark

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- c. What is a seed bank? Outline why a seedbank is vital in the conservation of the Brittle Greenhood. 2 marks

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- d. Describe the conservation management *and* monitoring techniques that could be employed to maintain and/or improve the numbers of the Brittle Greenhood. 4 marks

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**Question 3** (12 marks)

Current debate exists regarding the land that is currently occupied by a disused open-cut gold mine in northern Queensland.

The land surrounding the now-exhausted mine is bound by two mountain ranges. The major river that provides water to the mine and surrounding land has a catchment area of approximately 24,000km<sup>2</sup>.

50km south of the mine is a 520km<sup>2</sup> national park which is home to a variety of animal and plant species, including 4 species of threatened marsupials. The park is used for bushwalking, mountain-bike riding and general outdoor recreation by thousands of people every year.

The land inclusive of the mine site and the national park holds cultural significance for multiple indigenous groups and the traditional owners still use areas for cultural ceremonies.

Debate surrounds two options for use of the gold-mine land:

- **Proposal A** - involves rehabilitating the mine and expanding the current National Park to include this land. This option is substantially cheaper.
- **Proposal B** - involves using the old mine site to build a renewable energy hub. This proposal would see infrastructure built to capture solar and wind energy for conversion to electricity. The same proposal also includes making use of the mining pits and much of the current infrastructure to create a hydro-energy storage facility for the creation of electricity. Currently all electricity provided to this area of Queensland has its entire electricity grid generated by coal-fired power plants.

**a.** Which of the two options (Proposal A or Proposal B) is more ecologically sustainable?

In your response, evaluate the proposal using each of the following sustainability principles:

- intergenerational equity
- intragenerational equity
- conservation of biodiversity
- ecological integrity.

6 marks

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- b. i.** Name one stakeholder group that would hold an interest in **Proposal A**. Outline the role they may play in the decision making regarding the development of this land. 2 marks

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- ii.** Name one stakeholder group that would hold an interest in **Proposal B**. Outline the role they may play in the decision making regarding the development of this land. 2 marks

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- c.** Explain how the User Pays Principle could be applied to either proposal for development of the land. 2 marks

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**Question 4** (12 marks)

A project is underway in the development and construction of the largest energy storage battery in the southern hemisphere.

The project is set to house a 450 MW/hour battery which will help provide electricity to Victoria’s power grid during peak demand.

It is estimated that this project will cost the Victorian government \$84 million.

The installation of the battery will allow Victoria to move towards a greater reliance on renewable energy sources.

- a. Explain how this project will help contribute to Victoria’s renewable energy targets. 2 marks

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- b. Recently a fire broke out at the project site while engineers were testing features of the battery storage. The area contained a 13-ton lithium battery and the fire burned for at least 48 hours before fire crews were able to extinguish the flames.

State **ONE** negative impact this fire may have on any **TWO** of the Earth’s spheres: hydrosphere, atmosphere, lithosphere or biosphere. 4 marks

i. Earth’s sphere: \_\_\_\_\_

Negative impact:

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ii. Earth’s sphere: \_\_\_\_\_

Negative Impact:

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- c. Prior to the approval of this project, an external Environmental Consultant was required to undertake an Environmental Impact Assessment (EIA) of the project.

Describe the information that must be included in an EIA.

4 marks

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- d. During the planning stages for this project, it was suggested that the battery project should be located 150km west of its current site. It was argued that this location would allow for greater energy efficiency (as compared to its current site), as a large-scale wind farm is also found in the area.

Define the term energy efficiency and explain how locating the battery project close to a wind farm can improve energy efficiency.

2 marks

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**Question 5 (8 marks)**

Vanuatu is an island nation in the South Pacific Ocean. It is made of an archipelago of 83 islands and its main island, Efate, is home to approximately 70,000 people. Much of the population live in rural areas and do not have access to electricity. However, the population of the capital city, Port Vila, all have electricity provided to their homes. This electricity demand is met via both renewable and non-renewable sources.

Diesel (made from crude oil) is shipped into Port Vila and provides fuel for large scale generators on the island to generate 85% of the county’s electricity demands.

- a. Identify and outline **ONE** environmental disadvantage of using the diesel fuel generators for the island’s electricity supply. 2 marks

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- b. The Vanuatu Minister for Energy is currently working on two plans to increase the percentage of electricity generated from renewable sources from 16% to 25% by 2025.

**Plan One** - involves the building of five new wind turbines for placement on the southern tip of the island.

**Plan Two** - involves replacing the diesel fuel with biomass fuel created from coconut palm and nut debris.

Outline **ONE** disadvantage associated with each plan for increasing energy generated from renewable sources.

- i. **Plan One:** More wind turbines: 2 marks

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- ii. **Plan Two:** Replacement of diesel with biomass fuel: 2 marks

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- c. Each of the new wind turbines is capable of reliably providing 500 kW (kilowatt) of power.

Calculate the amount of MW (megawatt) this would provide to the island. Show your working.

2 marks

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**Question 6 (8 marks)**

**a.** Annotate a basic diagram of the natural greenhouse effect. Label the different types of radiation involved.

3 marks

**b.** Compare and contrast the natural and enhanced greenhouse effects.

3 marks

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**c.** Explain the mechanisms of the enhanced greenhouse effect in relation to the interaction of greenhouse gases and energy.

2 marks

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**Question 7 (8 marks)**

**a.** In the 1920's, the Serbian scientist Milutin Milankovitch hypothesized that the position of the Earth relative to the sun influenced Earth's long-term climatic patterns and is, in turn, responsible for triggering the beginning and end of glaciation periods.

**i.** How does Earth's position relative to the Sun influences long term climatic patterns? 1 mark

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**ii.** Outline the three Milankovitch cycles listed below. 3 marks

- Eccentricity:

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- Axial tilt:

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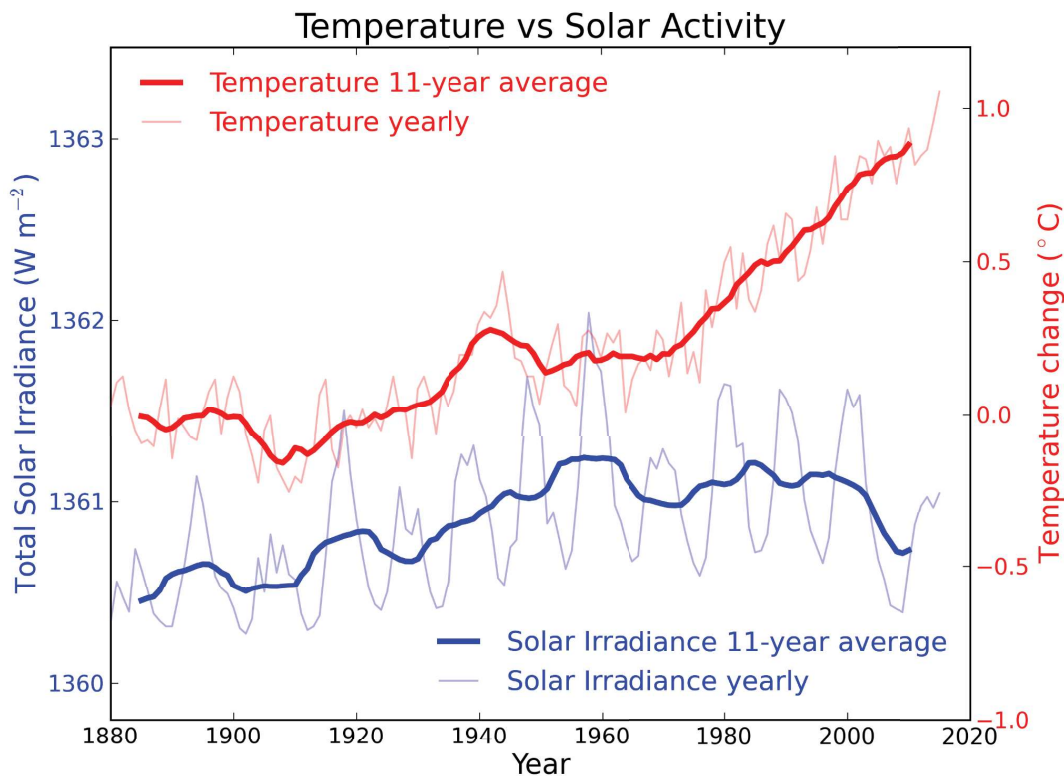
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- Precession:

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The graph below shows the trend in global temperature compared to the amount of solar energy hitting the Earth.



Source: Skeptical science <https://skepticalscience.com/solar-activity-sunspots-global-warming.htm>

b. Describe the trends in temperature and solar activity that can be seen in the graph above. 2 marks

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c. Using data from the graph above, explain the conclusions that can be drawn regarding the changes in solar activity and the Earth's temperature. 2 marks

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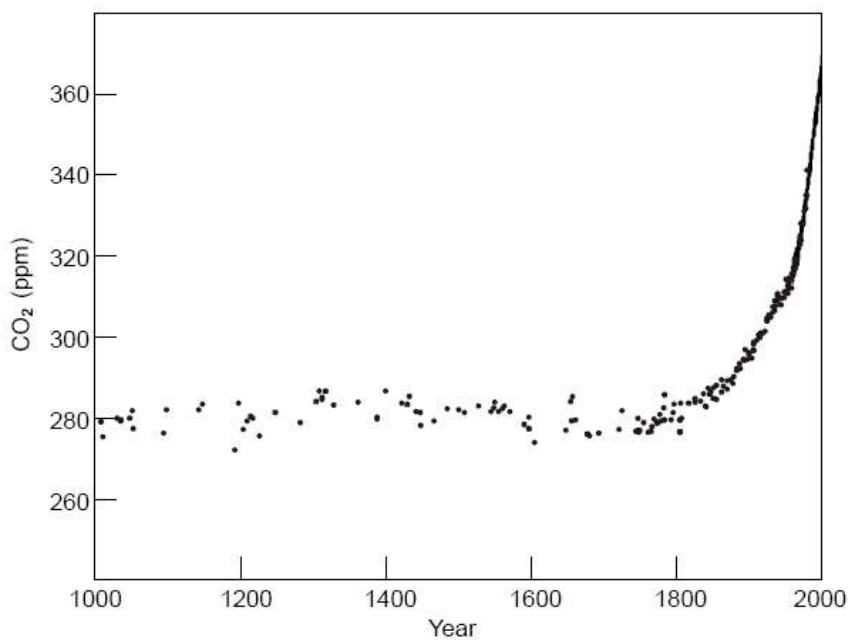
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**Question 8** (11 marks)

The following graph shows atmospheric carbon dioxide levels from the year 1000 to 2000.



Source: [https://www.researchgate.net/figure/fig1/Atmospheric-carbon-dioxide-over-the-last-1000-years\\_fig9\\_303684195](https://www.researchgate.net/figure/fig1/Atmospheric-carbon-dioxide-over-the-last-1000-years_fig9_303684195)

- a. Calculate the percentage change in atmospheric carbon dioxide levels from the year 1000 to 2000.

Show your working.

2 marks

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- b. The graph above includes data collected before the use of modern methods to record climate data.

- i. Explain **ONE** method used by scientists to collect atmospheric carbon dioxide levels before the use of modern methods.

2 marks

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**ii.** State a modern method of collecting atmospheric carbon dioxide data. 1 mark

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**iii.** Describe **ONE** impact of increased levels of atmospheric carbon dioxide on the carbon cycle. 2 marks

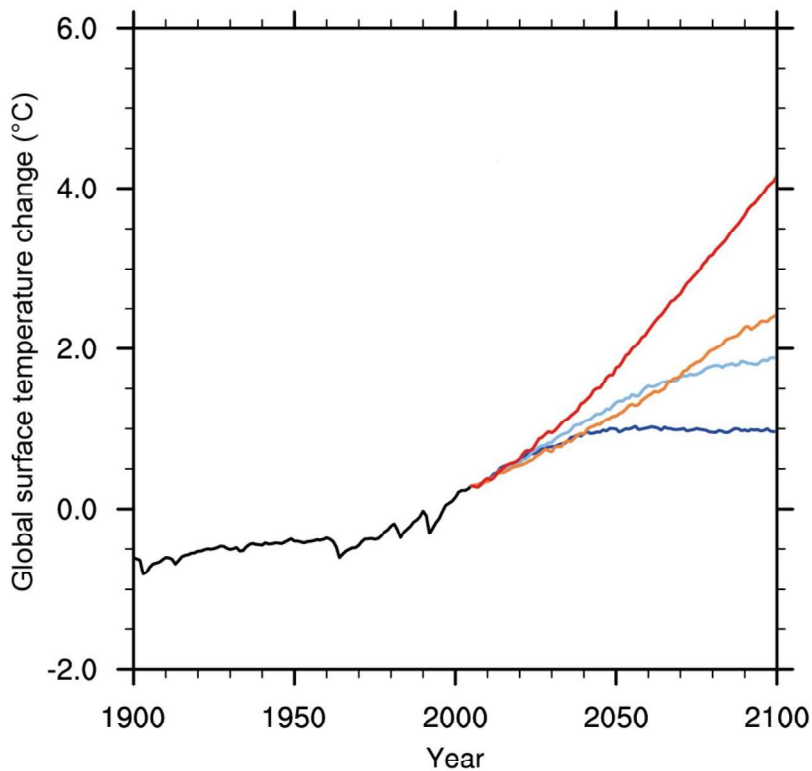
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The graph below shows four different predicted changes in global surface temperature to the year 2100.



Source: adapted from IPCC, 2013 and “future of climate change”, <https://climatechange.chicago.gov/climate-change-science/future-climate-change#Temperature>

c. Explain why there are four different predicted outcomes for the changes in global temperatures. 2 marks

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d. Explain the impact increased global temperatures will have on sea levels. 2 marks

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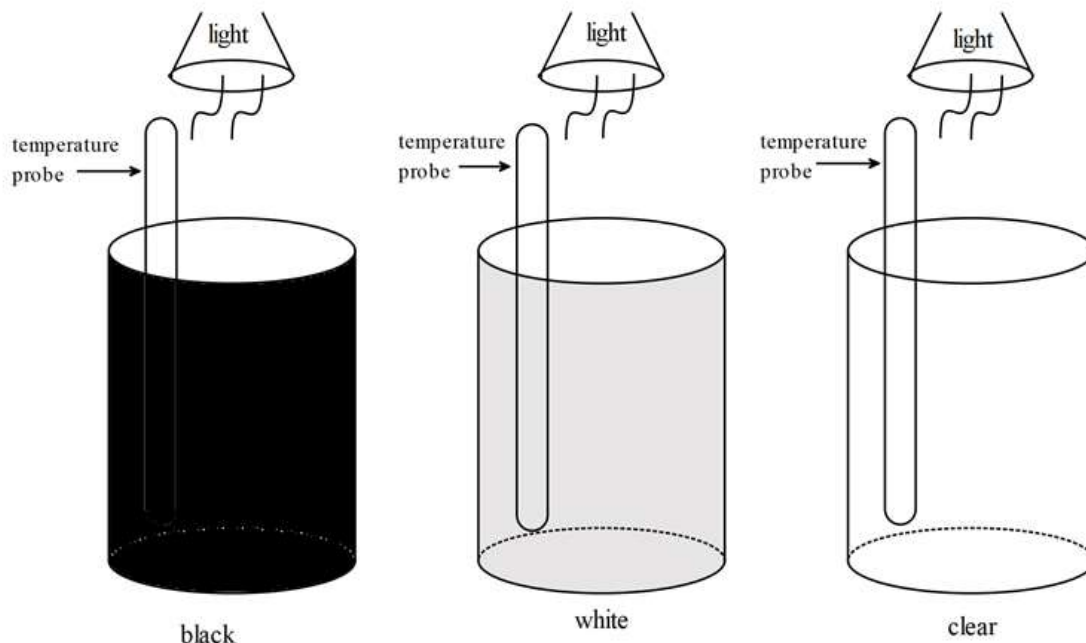
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**Question 9** (11 marks)

Students set up an experiment to investigate the albedo effect and temperature.

They set up 3 containers, one white and one black and one clear. Each container had a temperature probe, and a light source was placed the same distance from the containers and all containers were exposed to the light for the same amount of time. The lights were switched on at the same time and the temperature was recorded every 2 minutes.

A diagram of the experimental set-up is shown below.



- a. Write an appropriate hypothesis for this experiment. 2 marks

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- b. Identify the container that would be considered the control group. Explain your answer. 2 marks

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**c.** Identify **ONE** independent and **ONE** dependent variable for this experiment. 2 marks

- Independent variable:

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- Dependent variable:

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**d.** Explain **ONE** way that the experiment could be improved to make the data more reliable. 2 marks

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**e.** Using your knowledge of albedo and the albedo effect, explain the results you would expect from this experiment 3 marks

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**END OF QUESTION AND ANSWER BOOK**



## MULTIPLE CHOICE ANSWER SHEET

STUDENT NUMBER:    \_ \_ \_ - \_ \_ \_ - \_ \_ \_ - \_ \_ \_

Student Name: \_\_\_\_\_ Class: \_\_\_\_\_

Use a **PENCIL** for **ALL** entries.  
 For each question, shade the box which indicates your answer.  
 Marks will **NOT** be deducted for incorrect answers.  
**NO MARK** will be given if more than **ONE** answer is completed for any question.  
 If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.

ONE ANSWER PER LINE	ONE ANSWER PER LINE	ONE ANSWER PER LINE
1 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	11 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	21 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
2 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	12 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	22 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
3 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	13 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	23 <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
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