Victorian Certificate of Education

ENVIRONMENTAL SCIENCE

Trial Written Examination 1

August 2020

QUESTION AND ANSWER BOOK

TEACHER COPY / SOLUTIONS

Section	Number of Questions	Number of Questions to be answered	Number of Marks
A	**30**	**30**	**30**
B	**8**	**8**	**90**
Total			**120**

Materials

- Question and answer book of 25 pages
- Answer sheet for multiple choice questions
- At least one pencil and eraser
- One scientific calculator
- A Graphics Calculator is not allowed

Instructions

- Write your **student name** and **class** in the space provided on this book
- Write your student name and class in the space provided on your answer sheet for multiple-choice
- All written responses must be in English
- Time allowed: 15 minutes reading time, 120 minutes writing time

At the end of the examination

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

Special Thanks to Joanne Board of St Joseph's College Geelong and Melissa Nantsou of Iona College Geelong

SECTION A

Instructions for Section A

Answer all questions in the multipl- choice sheet provided. Write using blue or black pen.

Question 1

Of the following conservation categories, which one represents a species that is least at risk of extinction?

A. Critical

B. Vulnerable

C. Threatened

D. Endemic

The following information relates to questions 2 - 3.

A Victorian farmer purchased a large property in the Strzelecki Ranges in South Gippsland. The property had several small patches of remnant bushland and a stream running along the south section of the land. When a local officer from the Department of Sustainability carried out a wildlife survey, she discovered two small colonies of the endangered Filmy Maidenhair fern (*Adiantum diaphanum),* growing on rock faces along the stream.

Question 2

As part of the wildlife survey report, the farmer was advised to, if possible, conserve the native remnant patches in the southern area of his land, in order to conserve the habitat of these small, sensitive plants.

This advice would be regarded as:

A. Anthropocentric

B. Ecocentric

C. Biocentric

D. Species-centric

Question 3

The "endangered" conservation status of the Filmy Maidenhair has been issued as part of the action statement under the *Flora and Fauna Guarantee Act 1988 (Vic)*. This means that:

A. The remaining Filmy Maidenhair populations are legally protected in Victoria

B. The remaining Filmy Maidenhair populations are legally protected in all of Australia

C. It is illegal to trade or sell Filmy Maidenhair specimens in Victoria

D. It is illegal to trade or sell Filmy Maidenhair specimens in all of Australia

Question 4

Refer to the following photograph that shows a Common Reef Cleaner Wrasse (*Labroides dimidiatus*) alongside a Blue Tang (*Paracanthurus hepatus*). This species of small fish feeds on dead tissue, scales and parasites from the gills and mouth of many larger fish species.

In relation to the Cleaner Wrasse feeding on parasites and dead scales of the Blue Tang, the relationship between these two species can be classified as:

A. Parasite/ host

B. Mutualism

C. Commensalism

D. Non-symbiotic

Question 5

Human activities like land clearing and industrial agriculture can create pressures on species leading to their extinction.

Which one of the following combinations best describes the size of the gene pool, the susceptibility to extinction and the amount of genetic diversity?

	Size of gene pool	**Susceptibility to extinction**	**Amount of genetic diversity**
A.	Small	More susceptible	Low
B.	Large	More susceptible	High
C.	Small	Less susceptible	High
D.	Large	Less susceptible	Low

The following information relates to questions 6 - 7.

The Grey-headed Flying-fox (*Pteropus poliocephalus)* is native to the east coast of Australia, from Rockhampton in Queensland to Melbourne in Victoria. The Grey-headed Flying-fox is vital for the maintenance of a variety of woodland ecosystems.

Question 6

Which of the following is most likely to be the supporting service that Grey-headed Flying-foxes provide to the species of the woodland ecosystems?

A. Provision of food

B. Purification of air

C. Soil microbiome maintenance

D. Seed dispersal

Question 7

Recently, several populations of the Grey-headed Flying-fox have become isolated from one another due to the severe 2020 bushfires. One proposal, aimed at managing the reintroduction of these isolated populations, includes the rehabilitation of degraded and burnt roosting sites.

Which of the following describes a potential impact if this management strategy is unsuccessful?

A. A reduction of genetic diversity within the isolated Grey-headed Flying-fox populations due to inbreeding

B. A risk of genetic swamping when the Grey-headed Flying-fox comes into contact with other species of Flying-fox

C. An overall reduction of Flying-fox species diversity along the east coast of Australia

D. The formation of 'mega-diverse' regions of woodland due to the habitat fragmentation caused by the bushfires

Question 8

Ecologists are monitoring a critically endangered Flying-fox species on an island off the coast of Australia. They are carefully monitoring 2 small populations (Population A and Population B) that are in rapid decline due to habitat destruction and changing climatic conditions resulting in severe weather. An ecologist estimates that the probability of extinction in the next 15 years to be 0.20 for Population A and 0.60 for Population B.
The probability of both species becoming extinct within the next 15 years is:

A. 0.12

B. 0.40

C. 0.80

D. 1.20

Question 9

To estimate the size of the population of Purple-mottled Shore Crab (*Cyclograpsus granulosus*) on a section of rocky shore, a group of environmental science students are collecting data using the mark-recapture method. They captured, marked and released 75 crabs on the first day. Two days later, they captured 56 crabs, of which 35 had been marked. What is the best estimate of the population of the Purple-mottled Shore Crab on the section of rocky shore?

A. 54

B. 96

C. 120

D. 166

Question 10

As part of her field study, an environmental science student has chosen to investigate the species diversity of invertebrates on a rocky shore close to her home. Which of the following would not be an appropriate step in her method?

A. Place the measuring tape in a straight line, running from the beginning of the water, until the beginning of the sand dunes

B. Choose four areas along the tape measure to place the quadrats. Ensure to choose areas that have a wide variety of invertebrates

C. Choose four random areas along the tape measure to place the quadrats

D. In a results table, document species name and number within each quadrat

Question 11

Genetic testing has identified that there are three distinct Dingo populations on mainland Australia. The South-eastern, the North-western and the Fraser Island population. The Fraser Island Dingoes show a lesser degree of genetic diversity. This is an example of:

A. Genetic swamping

B. Genetic drift

C. Inbreeding

D. Extinction

Question 12

Deforestation is the permanent destruction of forests in order to make the land available for other use such as industrial agriculture. This process impacts which of the following of the Earth's spheres?

A. Biosphere, lithosphere and atmosphere only

B. Hydrosphere, atmosphere and biosphere only

C. Lithosphere, biosphere and hydrosphere only

D. Biosphere, hydrosphere, atmosphere and lithosphere

Section A - Continued next page

The following information relates to questions 13 and 14.

Vanuatu is an island nation in the South Pacific Ocean. It is made of an archipelago of 83 islands and its capital city, Port Vila, is home to a large harbour in which international and local shipping traffic regularly passes through.

Recently, fisheries managers noted a large number of Parrotfish (a large reef fish) were being killed by boat traffic in a section of Port Vila bay that passes through the reef at low tide. To reduce the number of animals being killed, they considered erecting floating buoy signs to warn boaters of the danger of travelling at low tide.

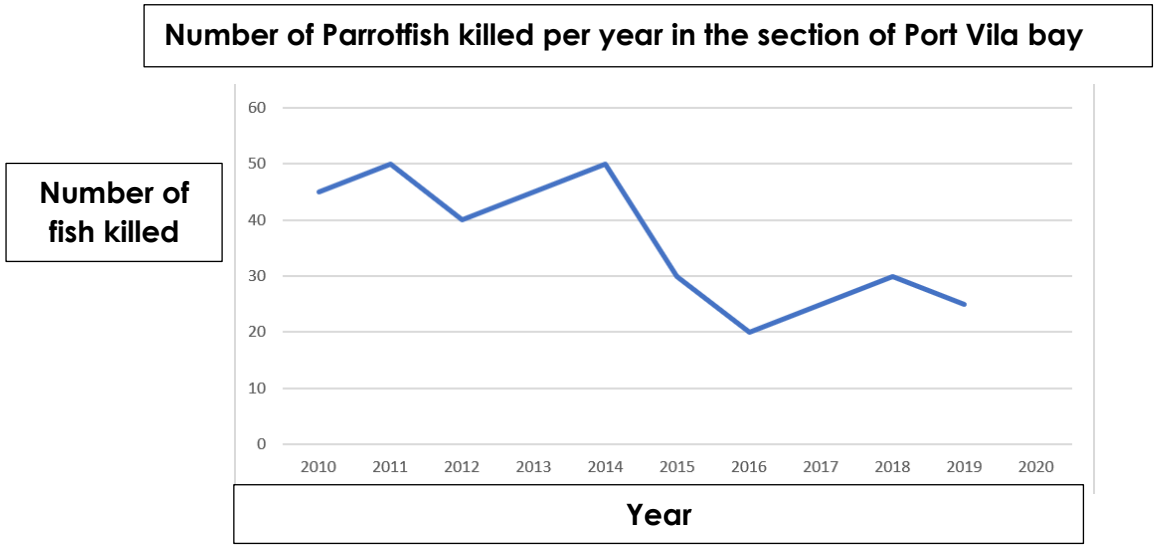
Question 13

In 2014, the managers had no evidence that the Parrotfish killed in the bay actually reduced the overall populations of Parrotfish. However, they decided to erect floating signs anyway to reduce any possible effects that these deaths might have on the Parrotfish populations.

This is an example of:

- **A.** Managing an introduced species
- **B.** Applying the precautionary principle
- **C.** Conducting a risk assessment
- **D.** Management of habitat destruction

The figure below shows the number of Parrotfish killed each year in this section of the bay before and after the warning signs were erected at the end of 2014



Question 14

In the period after the road signs were erected, 2015-2019 inclusive, the total number of Parrotfish killed was

- **A.** 110
- **B.** 120
- **C.** 130
- **D.** 140

Question 15

A local dairy farm is planning to release effluent, which includes liquid waste and sewage from the farm, into a nearby river. The outlet will feed the liquid waste into the river, which flows constantly during the year, during non-drought years. The wastewater will include nutrients from effluent, fertilizers, waste milk and cleaning products.

The local town council states that the wastewater outlet must be ecologically sustainable.

This means that the project must:

A. Not affect the ecology of the nearby ocean area in any way

B. Meet the needs of the current population without compromising the needs of future generations by maintaining good environmental health

C. Take into account the effects on the nearby human population

D. Maintain the biodiversity of the nearby riparian area

Question 16

Which of the greenhouse gases contributes most to the **enhanced greenhouse effect**?

A. Carbon dioxide

B. Water vapour

C. Methane

D. Nitrous oxide

2020 EDITION VCE Enviro.Science Prac. Exam amendment by the author -

Q16 answer should be carbon dioxide and not methane. This does not affect the question for the students but be careful using the answer guide when marking.

Question 17

Identify the list that only contains renewable resources.

A. Vegetable, wool, diamonds, water

B. Steel, coal, diamonds, plastic

C. Paper, wool, vegetables, water

D. Plastic, natural gas, cotton, paper

Question 18

The One Lead Mine is an open- pit lead mine in the tropical north of Queensland. Which of the following is potentially the most serious environmental threat from this mine?

A. Greenhouse gas emission

B. Pollutants entering local waterways due to production operations

D. Collapse of mine shafts

C. Tailings dam leaking during the summer wet season

Question 19

Identify the renewable energy resource best suited to providing a base load for a reliable electrical energy supply.

A. Geothermal

B. Solar electrical

C. Nuclear fusion

D. Wave generation

Question 20

Identify the name given to resources and processes that are supplied by nature for the benefit of humanity.

A. Biodiversity

B. Ecosystem services

C. Biota

D. Biomass

Question 21

Clear felling a large area of rainforest:

A. Reduces rainfall

B. Improves soil quality

C. Increases the reliability of rainfall

D. Increases the diversity of plants and animals

Question 22

Ocean acidification is mostly caused by:

A. Pollution from major cities

B. Increased amounts of dissolved carbon dioxide

C. Decreases amounts of dissolved carbon dioxide

D. Acid released in underground volcanic eruptions

Question 23

The Carbon biogeochemical cycles is an example of:

A. Regulation service

B. Previsioning service

C. Supporting service

D. Generative Service

Question 24

The main difference between weather and climate is:

A. The factors that are measured

B. The time frames they are viewed over

C. The size of the areas effected

D. None of the above

Question 25

Peak oil can be considered when:

A. Oil becomes more available

B. Oil becomes less available

C. Oil becomes more expensive

D. Both B and C

Question 26

Warm water is blown against Australia and Indonesia. This results in increased ocean evaporation, leading to greatly increased rainfall in these places. This is a description of:

A. Thermohaline circulation

B. Indian Ocean Dipole

C. El Niño

D. La Niña

Question 27

Identify the effect that rotation of the Earth on its axis has on oceans and atmosphere.

A. Coriolis

B. Albedo

C. Walker cell

D. Hadley cell

Question 28

What would be the effects if the ozone layer were destroyed?

A. El Niño would become more extreme

B. Earth's albedo would decrease

C. Increased risk of skin cancer

D. Coriolis effect would become stronger

Question 29

In the migration season, birds in the Southern Hemisphere were captured and placed in cages, each with a large compass drawn on the floor. The direction in which the birds hopped was measured over a 24hr period. At the end of the experiment it was found that most of the birds hopped due north.

Identify the independent variable in the scenario above:

A. Direction in which the birds hopped

B. Variety of bird species used for the investigation.

C. The compass drawn on the floor

D. The cages in which the birds where kept.

Question 30

An environmental scientist setting up a catch and release data collection point a short distance from a car park. This was because of the amount of equipment that is required to carry. This is an example of:

A. Accurate data collection

B. Validity data collection

C. Experimental bias

D. Good field data practice

End of Section A

SECTION B

Instructions for Section B

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

Question 1 (14 marks in total)

Melissa is a conservation scientist employed by the Department of Environment, Land, Water and Planning. She is studying the effect of the 2020 bushfires on the diversity of marsupial species in mountain areas of central and eastern Victoria. Melissa has collected data from two woodland sites (site A and site B) using the mark-recapture method. Site A contains the Leadbeater's Possum (*Gymnobelideus leadbeateri*) that is listed by the *Environment Protection and Biodiversity Conservation Act 1999* (Australia) as critically endangered. The lowland population estimates are less than 40 individuals meaning the species is at very high risk of extinction. The Leadbeater's Possum live in the wild in colonies of up to 12 individuals but only one pair per colony will breed. There have been attempts at captive breeding programs but there have been no individuals breed in captivity to date.

To inform the management strategy for the area Melissa must use the Simpson's Index of species diversity (D) to quantify the marsupial diversity of each of the eucalyptus woodland sites. 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: $\sum$ 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 a greater species diversity.

Species recorded at site A	**n_i**	**$n_i - 1$**	**$n_i (n_i - 1)$**
Common Brushtail Possum	35	35 – 1 = 34	35 x 34 = 1190
Common Ringtail Possum	34	34 – 1 = 33	34 x 33 = 1122
Leadbeater's Possum	7	7 – 1 = 6	7 x 6 = 42
Yellow-bellied Glider	7	7 – 1 = 6	7 x 6 = 42
Sugar Glider	25	25 – 1 = 24	25 x 24 = 600
Feathertail Glider	23	23 – 1 = 22	23 x 22 = 506
Eastern Pygmy-possum	5	5 – 1 = 4	5 x 4 = 20
N =	136		**$\Sigma[n_i (n_i - 1)] = 3522$**
$N(N - 1)$	18 360		

Therefore $$D = 1 - \frac{\sum[n_i(n_i - 1)]}{N(N-1)}$$

$$D = 1 - \frac{3522}{18\,360}$$

$$D = 1 - 0.192$$

$$D = 0.808$$

Simpson's Index (D) for site A is 0.808

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

(3 marks)

Species recorded at site b	**n_i**	**$n_i - 1$**	**$n_i (n_i - 1)$**
Common Brushtail Possum	54	54- 1 = 53	54 x 53= 2862
Common Ringtail Possum	30	30 - 1= 29	30 x 29= 870
Leadbeater's Possum	0	0 - 1= -1	0 x -1= 0
Yellow-bellied Glider	6	6 - 1 = 5	6 x 5 = 30
Sugar Glider	12	12 - 1= 11	12 x 11 = 132
Feathertail Glider	12	12 - 1 = 11	12 x 11 = 132
Eastern Pygmy-possum	5	5 - 1 = 4	5 x 4 = 20
N =	119		**$\Sigma[n_i (n_i - 1)]$ =4046**
N(N – 1)	14,042		

Therefore

$$D = 1 - \frac{\Sigma[n_i (n_i - 1)]}{N(N-1)}$$

$$D = 1 - \frac{4046}{14,042}$$

$$D = 1 - 0.288$$

$$D = 0.712$$

Simpson's Index (D) for site B is 0.712

b) Using your Simpson's Index (D) figures, justify whether site A or site B has a higher species diversity.

(2 marks)

1 mark – for identifying Site A has a higher species diversity.

1 mark – for identifying Site A as having a Simpson's Index figure of 0.808 and Site B has a Simpson's Index of 0.712. Therefore Site A's Simpson's Index is closer to 1, it's species diversity is higher

c) What is the mark-recapture method and why was this technique chosen to collect marsupial species data in these woodland ecosystems? (2 marks)

1 mark – for identifying the mark recapture method is a way of estimating population sizes of specific species. In this method, animals are caught in a harmless way (e.g pitfall traps), marked or tagged and released. Traps are then used again and numbers of tagged and untagged animals are recorded

1 mark – for identifying that this technique is chosen as it is not practical to be able to count every single marsupial individual

d) (1 + 2 = 3 marks)

i. Explain what is meant by the term species richness.

1 mark – for understanding that species richness is the number of different species in an ecosystem

ii. Using data from site A and site B, compare the species richness of these two sites.

1 mark – for identifying that Site A has a species richness of 7 different species while Site B has a species richness of 6 different species. Therefore, according to this data, Site A has a greater species richness

e) A concern Melissa has for Victorian marsupial species is a loss of genetic diversity as a result of the 2020 bushfires. State the meaning of genetic diversity. (1 mark)

1 mark – for identifying that genetic diversity refers to the variety of different genetic characteristics and genes that are found in a particular ecosystem.

f) Explain which site, A or B, requires intensive conservation efforts by scientists. (1+1+1 =3 marks)

1 mark – for identifying site A.

1 mark – for explaining site A due to the presence of the critically endangered Leadbeater's Possum

1 mark – for identifying the EPBC act and not just the higher species diversity.

Question 2 (6 marks in total)

In 2012, Healesville Sanctuary rescued the last three individuals from the Lake Mountain population after bushfire destroyed a population of around 300 Leadbeater's Possum in 2009. The three individuals were rescued after a feral cat was seen hunting around their nest boxes. These individuals did not produce offspring and are currently on display at Healesville Sanctuary. There are three main threats to wild populations of Leadbeater's Possum: 1) loss of hollow bearing trees, 2) wildfire and 3) restricted distribution.

a) Give a possible reason why the Leadbeater's Possum did not reproduce in captivity.
(1 mark)

1 mark – for identifying that the animals live in colonies where only one pair mate. There is a high probability that these individuals were not the breeding pair.

b) Justify your opinion as to whether it was ethical to remove these individuals for captive breeding purposes.
(2 +2 =4 marks)

2 marks - for the identification that the animals were under immediate threat and an appropriate justification with either predation as a context or lack of mate as a context

2 marks – for identifying the concept of beneficence and the justification that it would be more harmful to leave the population than to attempt a recovery program.

c) Identify the most appropriate reintroduction method for the Leadbeater's Possum into the wild
(2 marks)

1 mark – for identifying translocation

1 mark – for justifying this as the most appropriate due to fragmented habitat as described in the question stem: restricted distribution.

Question 3 (12 marks in total)

The Hooded Plover (*Thinornis cucullatu)* is a small, coastal dwelling, species of bird endemic to Australia. This species inhabits ocean beaches, especially those with extensive open dunes.

The Great Ocean Road Coastal Committee is a volunteer group that manages the conservation of hooded plover breeding sites along the south-western Victorian coastline from Whites Beach in Torquay to Moggs Creek.

Conservation strategies put into place to support the survival of these birds include; banning of dogs from dune areas where populations are known to nest, fencing off of nesting areas during breeding season and education of locals via signs and social media campaigns.

Photo credit: Great Ocean Road Coastal Committee

a) A major threat to the Hooded Plover populations in Victoria is low breeding success. Discuss how nesting in dunes, that back onto sandy beaches, can lead to low survival rate of Hooded Plover chicks. (3 marks)

1 mark – for identifying sand dunes may be walked on by people and dogs on their way to the beach.

1 mark – for identifying that people and dogs may accidentally trample on nests, eggs or baby chicks.

1 mark – for justifying that this can lead to death of chicks and therefore, not allowing them to survive to adulthood.

b) Currently the Hooded Plover is listed as vulnerable on the International Union for Conservation of Nature (IUCN) red list. Explain what this conservation status means in terms of assessment of the remaining population of Hooded Plovers. (2 marks)

1 mark – for identifying that vulnerable species are those that are a species that faces a high risk of extinction in the wild.

1 mark – for stating this status is less severe than endangered or critically endangered.

c) Suggest and explain one other conservation strategy that could be implemented to maintain and grow the populations of Hooded Plovers in Victoria. (2 marks)

1 mark – for appropriate suggestion which could include cages around nests to make it obvious that the nest is there OR

1 mark - for suggesting the control of predators for example baiting of other predators (cats, foxes) to avoid eating of chicks OR

Any valid suggestion (1) with a follow up explanation (1)

d) The Hooded Plover has been listed in the *Victorian Flora and Fauna Guarantee Act.* Outline the benefits of being listed as part of this regulatory framework. (2 marks)

1 mark – for stating that the species is legally protected

1 mark – for identifying that law requires conservation of the population in Victoria

e) The COVID-19 pandemic of 2020 has had a financially negative impact on the hospitality and tourism industry. The local Shire tourism minister has suggested a strategy to encourage greater numbers of tourists to the Ocean region. The strategy involves publishing the location of Hooded Plover nesting sites and allowing bird watchers and nature photographers access to the nesting sites.

Is this idea based on anthropocentric or ecocentric values? Justify your answer, making clear distinction between these two terms. (3 marks)

1 mark – for identifying the value as anthropocentric

1 mark – for justifying as an anthropocentric values as those that are based on the idea that human needs are more important than the needs of the environment

1 marks – for providing a clear comparison such as: ecocentric views are based on the idea that the needs of all species are equally as important as one another and that the environment is valued as equal to humans

Question 4 (13 marks in total)

The Galilee Basin, in inland western Queensland, is an area that covers approximately 247,000km^2. The area holds significance for multiple indigenous groups as well as being home to a variety of local endemic plant and animal species. A variety of ecosystem types exist in the area including tussock grasslands and open woodlands. The Galilee Basin also contains a complex pattern of rivers, wetlands and inland lakes that provide a diverse range of ecosystem services.

In 2019, Australian federal and Queensland governments approved construction of both an open-cut and underground coal mining project by an international energy company, Adani Power Limited.

When construction is complete, Adani Power Limited plans to mine coal from the Galilee Basin, transport the coal to a power station being built in Godda, India and burn the coal to provide energy for thousands of people in north-western India.

More than 1500 jobs have been created in engineering and construction of the mine as well as thousands more indirect jobs as a result of the mine's development. The Queensland government estimates the generation of billions of dollars in the first 30 years of the mine's operation.

The proposal includes transportation of coal via the Great Barrier Reef aboard huge ocean tankers on its journey to India.

a) In the table on the following page, justify whether the Adani Power Limited mine should be considered as ecologically sustainable development. As part of your answer consider 2 of the sustainability principles. (2+1+1 = 4 marks)

4 marks – 1 mark each for stating yes or no as to whether the mine is ecologically sustainable (either correct)

	Social	Economical	Environmental
Positive	Jobs Provide energy for people in India	Generation of billion of dollars Income from both direct and indirect jobs	Will stop burning of plastic to start fires in India
Negative	Destruction of indigenous significant sites Health issues from coal dust	Will have to spend money on regenerating site after mine is finished Will have to send money on regenerating GBR	Destruction of ecosystems to build mine GBR issues Rivers, wetlands affected by mine

b) Name one group of stakeholders that may hold interest in this project and outline their role. (3 marks)

1 mark – for anyone one of the following:

- local residents or
- STOP Adani group, or
- local indigenous community,
- or Adani shareholders

1 mark – for justification to the stakeholder interest.

1 mark – for correct identification of how the mine affects chosen group

EXAMPLE:

The STOP Adani group is one group of stakeholders in the mine (1) their role within the mine is as a volunteer group made of people from all over Australia that is campaigning against the mine (1). They are taking action against the mine by protesting and creating awareness of the destruction caused by the mine (1)

c) There are four challenges to sustainability. Identify which challenge this project address and justify your response? (2 marks)

1 mark – for identifying energy as the challenge to sustainability

1 mark – for justifying the identified challenge as the coal being mined will be used in electricity creation in India

d) A key transport option for the project is via a channel through the World Heritage listed Great Barrier Reef. Describe 2 key management strategies principles to ensure the safety of this transport method. (2 marks)

1 mark – for identifying the precautionary principle

1 mark – for identifying efficiency of resource use

e) Describe one impact that the Adani Power Limited mine project will be having on the hydrosphere within the Galilee Basin.

(2 marks)

1 mark – for describing the hydrosphere refers to the water on the earth

1 mark – for identifying coal mine will use water from the local groundwater, rivers and wetlands to keep the mine running which may drain those water sources faster than they can be replaced

Question 5 (13 marks in total)

The Ranger uranium mine official opened on the 1st of October 1981 under controversial circumstances and has operated continuously until the present time. Controversy arose when the mines proposed site would be within the World Heritage listed Kakadu National Park. Kakadu National Park encompasses a precious natural heritage. It protects valuable ecosystems of outstanding value, diversity and beauty and contains the world's richest breeding grounds for migratory tropical water birds. The boundaries of Kakadu National Park were drawn around the Ranger mine site through a series of political and administrative negotiations. In addition to the mine's exclusion from Kakadu, it was also excluded from the requirements of the Aboriginal Land Rights Act that would have otherwise given the Mirarr people the right to say no to the mine. The permit for the mine was granted to Rio Tinto for the length of 40 years therefore mining will cease in early 2021.

a) Describe two potential threats to biodiversity created by this project. (2 marks)

1 mark – for describing creation and isolation of small populations of organisms due to disruption of vegetation.

1 mark – for describing demographic variation due to small population due to disruption of vegetation.

b) Explain how the Ranger uranium mine project demonstrated a lack of environmental justice. (3 marks)

1 mark – for identifying that the exclusion of the mine from Kakadu meant that Aboriginal Land Rights Act was not relevant

1 mark – for mentioning any of the following - equal and fair treatment for all people regardless of race, color, sex, national origin, or income,

1 mark – for mentioning any of the flowing - with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies

c) The process of mining uranium at Ranger involved a large open pit mine. In 2021 the mine will cease operation as per the terms of its original permit. Energy Resources of Australia and Rio Tinto will then begin a five-year project to rehabilitate the Ranger uranium mine. The mine must be restored to a standard that would allow it to be incorporated within the surrounding Kakadu National Park.

i) Explain why uranium is considered a non-renewable energy source. (2 marks)

1 mark - for identifying that is not a fossil fuel

1 mark – for stating that non-renewable fuels take long to create than to exhaust.

ii) Name the three key modes of mine rehabilitation and give examples of how each would apply to the rehabilitations of the Ranger site. (6 marks)

3 marks – for identifying mechanical, chemical and biological.

3 marks – for adequately describing hoe each mode could be used at Ranger

Question 6 (13 marks in total)

Australia is made up of states and territories all of which are governed by three levels of government: Federal, State and Local. Only in the last 30 years have all the levels of government worked together and agreed on a set of laws and regulations to maintain environmental protections. One of those regulations is the need for developers to implement an Environmental Impact Statement (EIS).

a) An EIS is an example of what type of development? Justify your answer. (3 marks)

1 mark – for identifying that an EIS is sustainable development.

1 mark – for the justification of the development doing no harm to future generations.

1 mark – for the justification that the development can produce income and business within unjustly using resources

Victoria's West Gate Tunnel development in the Western metropolitan region of Melbourne is currently in a legal battle between the state Government and the construction company. Whilst digging the tunnel the construction company has dug up contaminated soil and are asking the State Government for more money to safely dispose of the soil.

b) Is this an example of the user pays sustainability principle? Justify your response (2 marks)

1 mark – For either a) yes it is because the construction company needs to contribute to the cost or b) the government should contribute to the cost.

1 mark – for identifying in either scenario that road users (the community) should not contribute to the cost of the disposal of the soil as opposed to the cost of the construction of the road itself.

c) Road transport has been a major contributor to CO_2 emissions globally. In an attempt to reduce the impact of atmospheric CO_2 emissions, technologies to advance carbon sequestration have been developed. Name 3 types of carbon sequestration and justify the use of one of the types as long-term solution. (5 marks)

3 marks – for correctly identifying in land, water and air.

1 mark – for correct justification for land sequestration as long term and

1 mark – for identification that underground storage is suitable for long term as trees and ocean will release the carbon again in a shorter time from.

d) Building freeways through populated urban areas provides multiple challenges. Identify one of those challenges and suggest an alternative to freeway construction including how it will assist with the impacts of the enhanced greenhouse effect. (3 marks)

1 mark – identifying health concerns as a challenge in urban areas.

2 marks – for the ability of the suggestion to enhance the environment for future generations. For example, the building of mass transport (suggestion) reduces carbon emissions therefore enhancing the environment for future generations.

Question 7 (4 marks in total)

The Earth's climate is a solar powered system. Globally, over the course of the year, the Earth system - land surfaces, oceans, and atmosphere - absorbs an average of about 240 watts of solar power per square meter (one watt is one joule of energy every second). The absorbed sunlight drives photosynthesis, fuels evaporation, melts snow and ice and warms the Earth system. For Earth's temperature to be stable over long periods of time, incoming energy and outgoing energy have to be equal. This balance is known as earth's energy budget.

a) Justify whether the radiation reflected by clouds is part of the energy budget and name the term used to describe this phenomenon. (2 marks)

1 mark – for correctly stating radiation reflected back into space is not part of the budget as it never reaches earth.

1 mark – for correctly naming albedo as the phenomenon

b) Describe the impact of melting ice caps on earths energy budget and justify how this would affect the enhanced greenhouse effect. (2 marks)

1 mark – for stating the melting ice would reduce earths albedo

1 mark – for identifying that a reduced albedo would decrease the amount of radiation being reflected increasing planetary warming

OR

2 marks – for correctly describing a positive feedback loop with melting ice caps as the context for an increase in warming

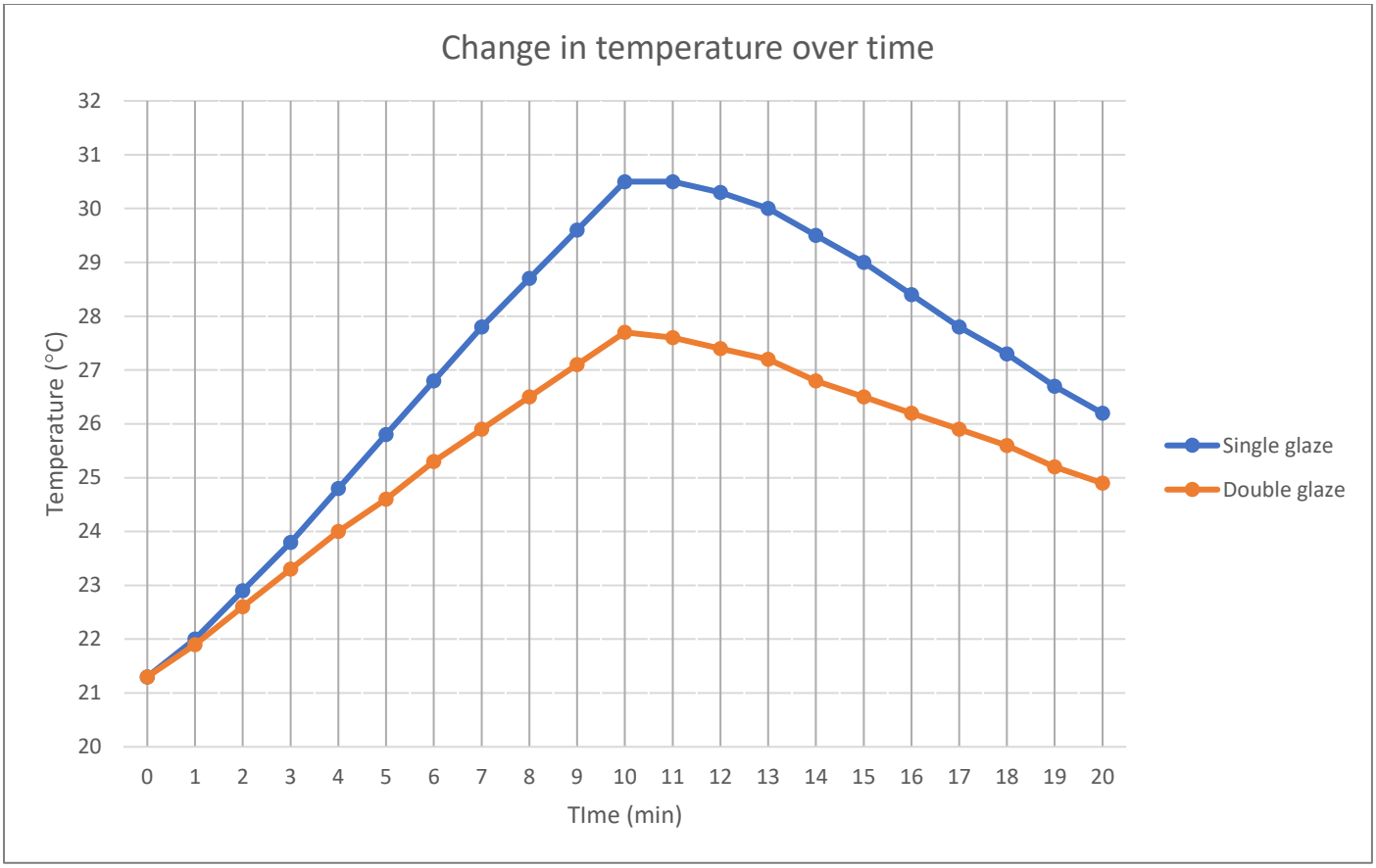
Question 8 (15 marks in total)

One way for buildings to be more energy efficient is to use double or triple-glazing in any glass windows or doors. Double and triple-glazing consists of two or three panels of glass separated by a spacer. The space between the panels is usually filled with Argon gas which is a poor conductor of heat. These panels of glass and gas filled spaces are then all sealed within the window frame. The diagram below shows the cross-section for double and triple-glazing.

A group of students conducted an experiment where they investigated the effect of single and double-glazed windows on the inside temperature of a simulated house. Two house simulations were set up, one with a single plastic panel (single-glazed), and one with two plastic panels with a gap of trapped air between the panels (double-glazed).

The students hypothesised that the single-glazed 'house' would heat up and cool down quicker than the double-glazed 'house', and the double-glazed 'house' would retain its temperature longer than the single-glazed 'house'.

Three cubes were constructed, with five sides having white plastic panels to simulate walls, floor and roof and one side having a clear plastic panel. Cube One had one clear plastic panel and Cube Two had 2 clear plastic panels with a sealed gap between the panels. A temperature probe was installed inside each cube. A heat lamp was placed 12 cm away from the clear plastic side and was angled to ensure the heat was directed onto the base of the cube. The initial temperature of each cube was recorded and then each minute after the lamps were turned on. After 10 minutes, the lamps were turned off and the internal temperature was continued to be recorded for another 10 minutes. The results of the investigation are shown on the next page.



a) State the independent variable used in this experiment. (1 mark)

1 mark – for identification of the type of glazing

b) Did the students collect qualitative or quantitative data? Make clear the difference between the two terms. (3 marks)

1 mark – for identifying quantitative

1 mark – for identifying quantitative is numerical data

1 mark – for identification that qualitative is descriptive/subjective/non-numerical data

c) What was the overall change in temperature for each of the cubes: (2 marks)
Single-glazed:
Double-glazed:

1 mark – for correctly identifying Single-glazed: 4.9°C
1 mark – for correctly identifying double-glazed: 3.6 °C

d) Identify which is the controlled variable? Indicate one example of a controlled variable in this experiment. (2 marks)

1 mark – for identifying controlled variable as a factor that is kept the same throughout the experiment
1 mark – for identification of a controlled variable
1 mark – for any one of: Type of panelling used is consistent, distance of lamp from cube, angle of lamp shining into house, placement of temperature probe.

e) Was the students' hypothesis supported? Explain using appropriate data. (3 marks)

1 mark – for correctly identifying yes.

1 mark – for describing the single-glazed cube heated up quicker than the double-glazed cube. Single-glazed reached a maximum temperature of 30.5°C compared to the double-glazed (max temp 27.7°C). Over the 10min 'cooling period', the single-glazed cube dropped 4.3°C whereas the double-glazed cube only dropped 2.8°C.

1 mark – for appropriate use of data.

f) Explain one way to ensure that the data collected is reliable. (2 marks)

1 mark – for identifying the need to conduct experiment multiple times and average results.
1 mark – for ensuring temperature probes/lamps working correctly and set up consistently.

g) Describe one benefit of installing double-glazing in glass doors and windows in residential housing? (2 marks)

2 marks – for any acceptable response for example: Less energy required to heat house (1mark), meaning less money for the consumer to spend on energy bills (1 mark)

END OF EXAM