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2024 Trial Examination

STUDENT NUMBER									Letter

ENVIRONMENTAL SCIENCE

Units 3 & 4 – Written examination

Reading time: 15 minutes
Writing time: 2 hours

QUESTION & ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	30	30	30
B	7	7	90
			Total 120

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is permitted in this examination.

Materials supplied

- Question and answer book of 20 pages.

Instructions

- Print your name in the space provided on the top of this page.
- All written responses must be in English.

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

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

Identify the list that only contains renewable resources.

A. hydro, gas, wind, solar

B. coal, gas, paper, nuclear

C. nuclear, coal, gas, oil

D. wind, hydro, geo, solar

Question 2

Which of the below options is a fossil fuel?

A. coal

B. geothermal

C. nuclear

D. solar

Question 3

What is the main concept behind the "user pays" principle in economic and environmental contexts?

A. the idea that only certain individuals are required to pay taxes

B. the belief that users should bear the costs associated with the goods or services they consume

C. the notion that the government should fully fund all public services without individual contributions

D. the requirement for businesses to cover their operational costs without external support

Question 4

The correct energy transfer diagram for a coal-fired power station is

A. solar $\rightarrow$ thermal $\rightarrow$ kinetic

B. solar $\rightarrow$ electrical

C. solar $\rightarrow$ kinetic $\rightarrow$ electrical

D. thermal $\rightarrow$ Kinetic $\rightarrow$ electrical

Question 5

Which of the following conventions would be effective in preventing the trafficking of African Elephants, a species that has been nearly hunted to extinction due to its high demand for its tusks?

A. IUCN red list
B. World heritage convention
C. CITES convention
D. *Flora and Fauna Guarantee Act*

Question 6

How can wildlife corridors aid in preventing species extinction and promoting population growth considering the importance of genetic diversity?

A. potential increase of the gene pool
B. reduction of inbreeding and genetic drift
C. allow escape from predation
D. decrease of disease spreading

Question 7

What is one of the key objectives of an environmental risk assessment?

A. to promote environmental pollution
B. to eliminate all uncertainties related to environmental impacts
C. to systematically evaluate the potential adverse effects of human activities on the environment
D. to prioritize economic interests over ecological concerns

Question 8

When managing a pollution event, what is a crucial step in the initial response phase?

A. ignoring the event until more information is available
B. quickly identifying the responsible parties and assigning blame
C. implementing immediate containment measures to prevent further spread
D. waiting for natural processes to self-cleanse the polluted area

Question 9

What is the primary function of the greenhouse effect in the Earth's atmosphere?

A. to cool the planet by reflecting sunlight back into space
B. to trap heat and maintain a consistent, liveable, temperature on Earth's surface
C. to shield the Earth from harmful solar radiation
D. to generate greenhouse gases that contribute to global warming

Question 10

What is the meaning of genetic diversity in a population or species?

A. the number of individuals in a population
B. the variety of ecosystems in a given region
C. the range of genetic traits and variations within a population
D. the distribution of organisms across different geographic locations

TURN OVER

Question 11

Why is genetic diversity considered important for ecosystem stability?

A. It increases competition among species, promoting natural selection.
B. Genetic diversity ensures uniformity and predictability within ecosystems.
C. It enhances the adaptability of a population to environmental changes.
D. Genetic diversity only plays a minor role in ecosystem stability.

Question 12

What is the consequence of inbreeding on genetic diversity within a population?

A. inbreeding has no impact on genetic diversity
B. it increases genetic diversity by promoting new variations
C. inbreeding decreases genetic diversity and increases the expression of recessive traits
D. inbreeding only affects physical characteristics, not genetic diversity

Question 13

In the biological rehabilitation of a mine site, what role do pioneer plant species typically play?

A. they are the initial colonizers, helping to stabilize the soil and create suitable conditions for other plant species
B. they have no relevance to the rehabilitation process
C. pioneer plants are avoided as they hinder the restoration efforts
D. pioneer plants are solely introduced for aesthetic purposes without contributing to ecosystem recovery

Question 14

What characterizes a mass extinction event in Earth's history?

A. a gradual decline in biodiversity over an extended geological period
B. an abrupt and widespread decrease in the number of species, affecting various taxonomic groups simultaneously
C. a localized extinction event impacting a specific ecosystem or habitat
D. a surge in species diversity leading to an exponential increase in the global population

Question 15

Which of the below options would correctly explain circular economy thinking?

A. A toy has been developed with all of the environmental issues mitigated.
B. A life cycle analysis has been completed for the production of a new computer.
C. All waste and pollution has been eliminated from the production of pencils.
D. Water bottles have now been made 100% recyclable.

Question 16
On a graph representing sea level rise, if the sea level increased from 20 centimetres to 25 centimetres, what is the percentage increase in sea level?
A. 20%
B. 25%
C. 30%
D. 40%

Question17
Consider a mark and recapture study conducted on a population of turtles. Initially, 50 turtles were captured, marked, and released. In a subsequent capture, 100 turtles were caught, and among them, 20 were marked. What is the estimated total population size based on the mark and recapture method?
A. 200 turtles
B. 250 turtles
C. 400 turtles
D. 500 turtles

Question 18
In the context of ecosystems, which of the following best describes provisioning services?
A. services that regulate and maintain the environment's balance
B. services that support biodiversity through habitat preservation
C. services that directly provide products or resources essential for human well-being
D. services that enhance cultural and recreational experiences in natural settings

Question 19
Ways in which households can reduce their impacts of energy use include:
A. regularly cleaning the seals on their refrigerator
B. switching to LED lights
C. eating less meat
D. all of the above

Question 20
Which factor contributes to the concept of Peak Oil?
A. increasing demand for alternative energy sources
B. advances in oil extraction technologies
C. declining global population
D. exhaustion of easily accessible and economically viable oil reserves

TURN OVER

Question 21
What is the primary source of energy harnessed in geothermal power plants?
A. solar energy
B. wind energy
C. Earth's internal heat
D. ocean currents

Question 22
What is the main advantage of geothermal power over some other renewable energy sources?
A. it is available only in specific geographical locations
B. it is completely independent of weather conditions
C. it requires extensive use of water resources
D. it has a higher carbon footprint

Question 23
What does intergenerational equity refer to in the context of environmental sustainability?
A. fair distribution of resources within a single generation
B. fair treatment of different generations based on their economic status
C. fair sharing of resources and opportunities between current and future generations
D. equal representation of various age groups in decision-making processes

Question 24
In a well-designed experiment, what is the role of the independent variable?
A. to be measured and observed as an outcome
B. to remain constant throughout the experiment
C. to be manipulated by the researcher to observe its effect on the dependent variable
D. to serve as a reference point for data analysis

Question 25
What is the purpose of a hypothesis in the scientific method?
A. to summarize the experiment's findings
B. to provide a rationale for conducting the experiment
C. to state the predicted outcome of the experiment
D. to outline the experimental procedure

Question 26
Which statement best describes the difference between accuracy and precision in measurement?
A. Accuracy refers to the consistency of repeated measurements, while precision reflects how closely measurements align with the true value.
B. Accuracy is the degree of closeness between a measured value and the actual value, while precision refers to the reproducibility of measurements.
C. Precision indicates the absence of random errors, while accuracy is the extent to which measurements agree with each other.
D. Accuracy is a measure of how finely a measurement can be made, while precision is the extent to which a measurement is free from bias.

Question 27
Which of the following statements best highlights a key difference between nuclear power plants and natural gas-fired power plants?

A. Nuclear power plants primarily rely on combustion of fossil fuels, while natural gas-fired power plants utilize nuclear reactions for electricity generation.
B. Natural gas-fired power plants release greenhouse gases during combustion, whereas nuclear power plants produce electricity through controlled nuclear reactions without emitting such gases.
C. Both nuclear and natural gas-fired power plants use the same technology to generate electricity, differing only in the type of fuel they employ.
D. Nuclear power plants are known for their lower efficiency compared to natural gas-fired power plants, which operate with higher energy conversion rates.

Question 28
If the average global temperature increased from 1.2 degrees Celsius to 1.8 degrees Celsius over a 10-year period, what is the percentage increase in temperature?

A. 33.3%
B. 40%
C. 50%
D. 60%

Question 29
What is a characteristic of qualitative data in research?

A. it is numerical and measurable
B. it involves the collection of opinions, attitudes, or descriptions
C. it is analysed using statistical methods
D. it provides a quantifiable measure of variables

Question 30
In research and decision-making, what is a key benefit of utilizing historical data?

A. Historical data provides real-time information for immediate analysis.
B. It helps in predicting future events with absolute certainty.
C. Historical data offers insights into past trends and patterns.
D. It replaces the need for current data collection methods.

END OF SECTION A
TURN OVER

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.

Question 1 (17 marks)

Captive breeding is a well-used conservation method that has been employed many times throughout history. This method keeps plants and animals that are endangered in controlled settings. Zoos, aquariums, and specific gardens are used to provide a safe habitat for these endangered organisms. Programs are often run to help provide funding for the upkeep of the enclosures.

a. Identify and explain two advantages of a captive breeding program.

4 marks

b. Identify and explain two disadvantages of a captive breeding program.

4 marks

In the alpine areas of Victoria, there is an isolated population of Mountain Pygmy Possums. This isolated population contains only 70 individuals.

c. Suggest a conservation strategy that could be used to increase the population numbers of the Mountain Pygmy Possums.

_____

_____

_____

_____

2 marks

d. Scientists have decided to reintroduce the possums to a different habitat. Outline the limitations that this method presents.

_____

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_____

_____

2 marks

e. Local farmers have identified that there is a risk of the possums being injured or caught up on the barbed wire fences. Explain a management strategy that could be used to mitigate this risk.

_____

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_____

_____

_____

3 marks

TURN OVER

f. The possum is endemic to the alpine area. Explain what an endemic organism is and its importance in an ecosystem.

_____

_____

_____

_____

_____

2 marks

4 + 4 + 2 + 2 + 3 + 2 = 17 marks

Question 2 (15 marks)

A group of students went on an excursion to a local zoo. They undertook a program about native wildlife. Below are the species Fred and Tina recorded at Site A.

The Simpson's Index of species diversity (D) is commonly used by environmental scientists in the quantification of species diversity and was used during this field study. The index (D) can be calculated using the following formula.

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

Where:
$\sum$ refers to sum of
n_i refers to the total number of organisms of each individual species
N refers to the total number of organisms of all species

This formula should produce a value between 0 and 1. A higher index value (that is, a number closer to 1) indicates higher species diversity.

a. Use the figures in the table below and the spaces provided to calculate the Simpson's Index for Site A. 3 marks

Species recorded at site A	**n_i**	**$n_i - 1$**	**$n_i\,(n_i - 1)$**
Blue tongue Lizard	2		
Magpie	26		
Brown Snake	1		
Bandicoot	90		
Emu	56		
Kangaroo	160		
Rabbit	900		
N =			**$\sum[n_i\,(n_i - 1)]$ =**
$N(N-1)$ =			

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

D = 1-

D = 1-

D =

The Simpson's Index for site A is _____

b. Use the figures in the table below and the spaces provided to calculate the Simpson's Index for Site B. 3 marks

Species recorded at site B	**n_i**	**$n_i - 1$**	**$n_i\,(n_i - 1)$**
Blue Tongue Lizard	4		
Magpie	90		
Brown snake	8		
Bandicoot	200		
Emu	6		
Kangaroo	250		
Rabbit	0		
N =			$\sum[\boldsymbol{n_i\,(n_i - 1)}]$ =
$\boldsymbol{N(N-1)}$ =			

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

D = 1-

D = 1-

D =

The Simpson's Index for site B is_____

TURN OVER

c. Which site has the highest species diversity? Make clear the definition of species diversity in your answer.

2 marks

d. Does site A have a higher richness than B? Explain.

2 marks

e. Suggest one method that could be used to collect the data observed. Provide a limitation and benefit of this method.

3 marks

f. How has the presence of an invasive species impacted the biodiversity of Site A when compared to Site B?

2 marks

3 + 3 + 2 + 2 + 3 + 2 = 15 marks

Question 3 (16 marks)

Australia is dependent on non-renewable energy sources. The Australian government has begun looking into increasing the number of renewable sources of energy used.

a. Name three renewable energy sources and outline to what degree they currently contribute to Australia's energy needs.

1.

2.

3.

3 marks

b. Identify an advantage and disadvantage for each energy source listed in **a**.

Advantage	Disadvantage
1	1
2	2
3	3

6 marks

TURN OVER

c. Identify the most relevant renewable energy source and explain how this renewable energy source would be the most appropriate to replace non-renewables for energy production in Australia.

3 marks

d. Choose a non-renewable energy source. Outline TWO limitations of this non-renewable energy source and suggest how these might be overcome.

4 marks

3 + 6 + 3 + 4 = 16 marks

Question 4 (19 marks)

A town on the coast of Australia has decided to invest in a more sustainable way of life. This shift to sustainability would include wind turbines off the coast, solar panel farms, revegetation of dunes, improved walking and biking paths and dedicated information sessions about sea turtle egg laying.

They would be moving away from coal-fired power plants, off-coast oil rigs, the planting of non-native species along the walking paths and little to no stakeholder consultation.

a. With a focus on intergenerational equity, and conservation of biodiversity and ecological integrity decide if this shift is possible. Justify your answer.

5 marks

b. Identify two stakeholders for the development of the walking and biking path.

2 marks

TURN OVER

c. Explain the priorities of one of the stakeholders for the development.

2 marks

d. Revegetation of the dunes will help to increase habitat. How will this affect biodiversity?

2 marks

e. Using the table below compare the effects of the different spheres of the offshore oil rigs vs the solar panel farms. (HINT: the effects can be positive or negative)

	Predicted effect from oil rig	**Predicted effect from solar panel**
Hydrosphere		
Lithosphere		
Atmosphere		
Biosphere		

8 marks

5 + 2 + 2 + 2 + 8 = 19 marks

Question 5 (8 marks)
The Amazon Rainforest spans across several countries in South America, with the majority of it located in Brazil, and it is one of the largest and most biodiverse ecosystems in the world. Over the years, the region has been the focus of various development initiatives, presenting a complex interplay between economic growth, environmental conservation, and social considerations.

As the primary custodian of the Amazon Rainforest, Brazil has faced the challenge of balancing development aspirations with the need to preserve this ecologically significant region. The Amazon has been subject to various development activities, including logging, agriculture, and infrastructure projects, driven by economic interests and the country's pursuit of growth.

However, these activities have led to several challenges, including deforestation, which has been a major driver of biodiversity loss and contributed to increased greenhouse gas emissions. The expansion of agriculture, particularly cattle ranching and soy cultivation, has been a significant threat to the Amazon's ecosystem.

Additionally, the Amazon is home to numerous indigenous communities, and development projects often without proper consultation, have resulted in the displacement of indigenous peoples, leading to conflicts over land and resources.

The Amazon plays a crucial role in global climate regulation and carbon sequestration, and deforestation not only threatens local ecosystems but also has far-reaching consequences for climate change, affecting weather patterns and exacerbating global warming.
Challenges:

- Deforestation: The expansion of agriculture, particularly cattle ranching and soy cultivation, has been a major driver of deforestation in the Amazon. Large-scale clearing of land for these activities has led to significant biodiversity loss and contributed to increased greenhouse gas emissions.
- Indigenous Rights: The Amazon is home to numerous indigenous communities, whose livelihoods are intimately connected to the rainforest. Development projects, often without proper consultation, have resulted in the displacement of indigenous peoples, leading to conflicts over land and resources.
- Global Impact: The Amazon plays a crucial role in global climate regulation and carbon sequestration. Deforestation not only threatens local ecosystems but also has far-reaching consequences for climate change, affecting weather patterns and exacerbating global warming.

TURN OVER

There are four value systems associated with environmental science. Using each one justify the development of the Amazon with reference to ecosystem services.

View	Justification

8 marks

Question 6 (15 marks)

a. Ice cores are used to provide information on past levels of greenhouse gases in the atmosphere, such as carbon dioxide, which can help inform future climate change projections. List two other methods that could be used to measure climate change over time.

_____

_____

_____

2 marks

b. How can the analysis of ice core samples, as described in part a., provide valid information to measure climate change accurately? Please provide a detailed explanation.

_____

_____

_____

_____

3 marks

c. Using a different method from part a. provide two limitations to using this method.

_____

_____

_____

_____

2 marks

TURN OVER

d. Sea level rise is a very good indicator of global temperature. Explain the two ways in which the sea can rise.

_____

_____

_____

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_____

4 marks

e. Explain how sea level rise can be used to provide information about climate change.

_____

_____

_____

_____

2 marks

f. Define albedo. What is the link between albedo and global temperature?

_____

_____

_____

_____

2 marks

2 + 3 + 2 + 4 + 2 + 2 = 15 marks

END OF QUESTION AND ANSWER BOOK