Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.

2. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

3. You should make sure you answer all parts within each question so that the criterion can be assessed.

4. This examination is 3 hours in length. It is recommended that you spend approximately 36 minutes in total answering the questions in this booklet.

5. The 2018 External Examination Information Sheet for Environmental Science can be used throughout the examination.

6. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 2** Develop, interpret and analyse experiments and investigations.
Question 1

After studying long-term data, a scientist noted that bushfires in southern Australia are more likely to occur on days when the humidity drops unexpectedly from that experienced over the proceeding few days, as shown in the table.

<table>
<thead>
<tr>
<th>Day</th>
<th>Humidity (%)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturday</td>
<td>49</td>
<td>27</td>
</tr>
<tr>
<td>Sunday</td>
<td>62</td>
<td>32</td>
</tr>
<tr>
<td>Monday</td>
<td>55</td>
<td>38</td>
</tr>
<tr>
<td>Tuesday</td>
<td>57</td>
<td>36</td>
</tr>
<tr>
<td>Wednesday*</td>
<td>4</td>
<td>38</td>
</tr>
</tbody>
</table>

*The fire occurred on Wednesday.

The scientist proposed the following hypothesis:

“The incidence of fire is greater on days of relatively low humidity.”

(a) Identify the Independent and Dependent Variables in this hypothesis. (2 marks)

(i) Independent Variable: .................................................................

(ii) Dependent Variable: .................................................................

(b) From what you understand about writing a good hypothesis, in what ways is this a good hypothesis? (2 marks)

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(c) In what way is this NOT a good hypothesis in relation to the data? (1 mark)

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Question 2

The following graph shows the changing probability of survival of various types of species.

(a) According to the graph, state the species type with the best chance of survival in 2010. (1 mark)

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(b) Suggest ONE reason for the probability of a decline in coral species during the time period shown on the graph. (1 mark)

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(c) Rewrite your suggestion as a hypothesis. (3 marks)

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The CSIRO’s research vessel RV Investigator has been involved in surveying the Southern Ocean between Tasmania and Antarctica.

The ship studies the properties of both the oceanic waters and the sea floor below. Various study methods are used but these generally involve a simple pattern. The ship criss-crosses the ocean in a grid pattern taking samples and measurements of the water as it travels. Every so often the ship carries out more intensive studies of a particular area that might involve taking biological and geological samples from the sea floor.

(a) State the name given to the survey technique that involves crossing a particular area taking measurements along a straight line. (1 mark)

(b) Identify another sampling technique that is described in the passage above. (1 mark)

(c) Predict two organisms that may be found in the sea floor samples. (1 mark)
Question 4

The aerial photograph, taken with a quadcopter, shows a part of a previously unknown Adélie penguin (*Psygoscelis adeliae*) breeding colony on Heroina Island, Danger Islands, Antarctica. Each black dot is a penguin sitting on a nest.

Describe how this photo could be used to estimate the population of penguins breeding at this site. (3 marks)

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Question 5

In the 1990s an extensive survey of Australia’s wildlife was carried out and published in 1996 by the Federal Government as the *State of the Environment Report*. The fieldwork that gathered data for this report used many different techniques.

(a) Even though the data was collected 20 years ago and used many different techniques, explain why the data is still of value to current land managers. (3 marks)

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(b) Explain why data collected today may be different in comparison to the data from 20 years ago. (1 mark)

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Question 6

The Coastal Wattle or Boobyalla (*Acacia sophorae*) colonises the land behind sand dunes at many Tasmanian beach locations. This environment is slightly saline due to sea spray. However, scientists are concerned that with sea level rise, the areas where Boobyalla grows may become increasingly salty and the plant may struggle to reproduce because its seeds cannot germinate in an environment that is too salty.

A scientist carried out the following experiment to determine the optimum salinity for the germination of Coastal Wattle seeds. Batches of 100 seeds were placed in containers containing cotton wool soaked in solutions of increasing concentrations of salt water from 1% to 10%, as well as one container that used fresh water. The containers were open to the air but the cotton wool was not allowed to dry out. Monitoring occurred daily to count the number of seeds that had germinated.

(a) Explain the purpose of using a container with cotton wool soaked in fresh water. (2 marks)

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(b) Explain why the cotton wool was not allowed to dry out during the experiment. (1 mark)

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Question 6 (continued)

(c) Apart from using a container with fresh water, explain THREE other features that make this a good experiment. (6 marks)

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The number of seeds germinated within the period of one week was counted and the results were graphed.

(e) State the optimum concentration of salt water for Coastal Wattle seed germination. (1 mark)

(f) Explain what follow up steps are necessary to determine whether Coastal Wattles are threatened by sea level rise. (2 marks)
This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Office of Tasmanian Assessment, Standards and Certification.
ENVIRONMENTAL SCIENCE
(ESS315118)

SECTION 2
Time: 36 minutes

Candidate Instructions
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6. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

Criterion 5 Apply ecological concepts and processes.

Section Total: /34

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Question 7

The following diagram shows the organisms present in a marine ecosystem. The phytoplankton are microscopic plants (e.g. algae, diatoms and dinoflagellates) which float freely in the surface waters of oceans. Phytoplankton are the start of aquatic food chains. Microscopic sea animals called zooplankton feed on the phytoplankton. Numerous whiting and flathead (fish) feed on the zooplankton. Crabs feed on the remains of the various fish and other creatures. Sharks feed on the whiting and flathead as well as crabs.

(a) Using the names of the organisms in the figure above, construct a food web and label the trophic levels. (5 marks)
Question 7 (continued)

(b) Name the main ecological function/role of the crab. (1 mark)

(c) Explain why whiting and flathead are in competition. (1 mark)

(d) (i) State the main source of energy for the community. (1 mark)

(ii) State a secondary source of energy. (1 mark)

(e) Ocean acidification experiments show a future reduction in zooplankton biomass. Predict the short term effect this would this have on:

(i) the fish species. (1 mark)

(ii) the phytoplankton. (1 mark)
Question 8

The Portuguese Millipede (*Ommatoiulus moreleti*) is a small invertebrate up to 30mm long. In the last 20 years it has successfully established itself in various Australian ecosystems including Tasmanian urban areas. Despite the increase in population of the millipede, it appears that it has had no impact upon the local flora and fauna. An expert claimed that its success was due to the fact that

“the millipede seems to have invaded an empty niche.”

(a) Using the example of the Portuguese Millipede, explain what is understood by the concept of a niche. (1 mark)

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(b) Explain why the Portuguese Millipede has been so successful. (4 marks)

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Question 8 (continued)

In Europe, the number of millipedes is controlled by predation from hedgehogs (a small mammal) and the fact that millipedes cannot survive as adults when the temperature drops below 17°C.

(c) State whether these two limiting factors are biotic or abiotic factors. (1 mark)

Hedgehogs

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Temperature

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A Tasmanian resident investigated whether the number of millipedes was increasing each year and counted them whenever they disposed of them. The resident found that there were no millipedes in winter but in the warmer months, when millipedes were present, the numbers remained constant from one year to the next. This could be explained by the millipede’s seasonal breeding. The adults lay many eggs before dying and these eggs hatch in spring.

(d) Label the axes below and draw a population curve for a period of five years after the millipede’s introduction to Tasmania. (3 marks)

(e) Give a name for the type of cycle depicted in your graph. (1 mark)

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Question 9
State whether the following environmental scenarios are an example of positive or negative feedback, and give a reason for your choice. (6 marks)

(a) The melting of sea ice with global warming leads to a darker sea surface that will absorb more heat from the sun.

(b) A scientist estimated that it takes 15 years for the carbon dioxide from the large forest fires that occur due to land clearing in the Amazon Basin to be reabsorbed into plants.

(c) Vegetable scraps are placed into a compost heap and then the compost is used to fertilise the vegetable garden.

(d) After large bushfires in Australia, the loss of vegetation means there is no transpiration and so clouds cannot form. This means there is less rain and a change to more fire-prone vegetation.
Question 10

(a) A modern approach to improving air quality in office buildings is to use indoor plants as “air conditioners”.

Use your knowledge of the carbon cycle to explain how the plants can act as air conditioners. (2 marks)

(b) One reason that conservation groups advocate old growth forests should not be logged, is because these forests act as carbon sinks. Explain what is meant by a carbon sink. (2 marks)

(c) Name and outline how carbon dioxide is released from TWO other carbon sinks. (3 marks)
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On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

Criterion 6  Apply concepts and processes of ecosystem change.
Question 11

Tasmanian marine ecosystems are under threat from a number of introduced species including the Northern Pacific seastar (*Asterias amurensis*), the Long-spined Sea Urchin (*Diadema antillarum*), and the seaweed *Undaria sp*. Terrestrial ecosystems are also potentially under threat from the European Red Fox (*Vulpes vulpes*) as well as many plants that are weeds. Government departments and conservationists are continually waging an expensive and time consuming battle against these species.

Outline how introduced species pose a threat to Tasmanian ecosystems using some examples from above. (4 marks)

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Question 12

One of the greatest drivers of change in Australian weather patterns is the El Niño effect.

Complete the following table by circling the appropriate choice in the right column during an El Niño event. (3 marks)

<table>
<thead>
<tr>
<th></th>
<th>During El Niño</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall in Australia</td>
<td>Flood / Drought</td>
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<tr>
<td>Rainfall in South America</td>
<td>Flood / Drought</td>
</tr>
<tr>
<td>Southern Oscillation Index</td>
<td>Increases / Decreases</td>
</tr>
<tr>
<td>Upwelling of Humbolt Current</td>
<td>Normal / Reduced</td>
</tr>
<tr>
<td>West Flowing Ocean Circulation Currents</td>
<td>On the surface / Deeper in the ocean</td>
</tr>
<tr>
<td>Peruvian Fishing Catch</td>
<td>Increased / Reduced</td>
</tr>
</tbody>
</table>
Question 13

Roebuck Bay is a world-renowned bird-watching location near Broome, Western Australia. The birdlife is mostly migratory wading birds that have a short breeding season in the far Northern Hemisphere. While in Roebuck Bay, the birds feed on invertebrates as the estuarine mudflats become exposed when the water recedes.

(a) Circle the Roebuck Bay conditions best suited for viewing migratory wading birds. (1 mark)

Summer / winter  low tide / high tide

(b) Explain your choices. (3 marks)

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Question 14

The Thylacine, or Tasmanian Tiger (*Thylacinus cynocephalus*), once ranged over the whole of the Australian continent. This is evidenced by images painted as cave rock art in Kakadu, in the Northern Territory, and Thylacine skulls found in caves on the Nullabor Plain, in South Australia. The Thylacine became extinct in Tasmania in 1936. It was thought to have become extinct on the mainland about 4 000 years ago, when the Dingo (*Canis lupus dingo*) was introduced into Australia.

Recent studies have shown that the Thylacine may have already been destined for extinction because there was very little variation in its genetic make-up that would enable it to combat disease or adapt to climate change.

The Thylacine formerly inhabited moist temperate forests that adjoined grassland. In Kakadu, the area is now dry savannah woodland and the Nullabor is a desert.

With reference to the above information, describe the three types of biodiversity. (5 marks)

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Kakadu
Question 15

The following graph of seawater pH shows the data obtained from a monitoring station off the coast of Hawaii in the Pacific Ocean, over the last 30 years.

(a) What is measured using a pH scale?  
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(b) Using your answer above, describe what the trend of this graph tells us.  
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(c) Describe how a change in pH of seawater comes about.  
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Question 16

The following diagram shows a schematic section through a Tasmanian old growth forest. The tallest Eucalypt trees are about 90 m high.

(a) State why this forest is described as 'mixed forest' not 'rainforest'.

(b) Estimate the age of the forest since it was last burnt, giving reasons for your answer.

Question 16 continues.
Question 16 (continued)

(c) Explain why there are different sized trees of the same forest species. (3 marks)

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Question 17

The photo below shows an aerial view of the Arctic Island of Greenland, which is located at high latitudes in the North Atlantic Ocean.

Greenland was named 1 000 years ago by the colonising Vikings in reference to the fact that it offered good, green farmland at that time. This farming ceased about 500 years ago. Only recently has farming been able to recommence.

(a) State why large parts of Greenland were ice-free between 500 and 1000 years ago.

(1 mark)

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Question 17 continues.
The Indigenous occupants of Greenland survived by hunting whales, seals and polar bears. Fishing was only a very small-scale activity. Recently Greenlanders have begun large-scale commercial fishing activities because large populations of fish are occurring due to the factors of global warming and the melting of the ice cap and valley glaciers.

(b) Explain how the two factors of global warming AND the melting of the ice cap and valley glaciers combined produce large populations of fish. (4 marks)
ENVIRONMENTAL SCIENCE
(ESS315118)

SECTION 4
Time: 36 minutes

Candidate Instructions

13. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.

14. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

15. You should make sure you answer all parts within each question so that the criterion can be assessed.

16. This examination is 3 hours in length. It is recommended that you spend approximately 36 minutes in total answering the questions in this booklet.

17. The 2018 External Examination Information Sheet for Environmental Science can be used throughout the examination.

18. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 7**  Apply concepts relating to human dependence and impact on ecosystems.

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‘Natural Capital’ is a term that refers to the Earth’s resources that could be useful for humans. These resources are classified as renewable or non-renewable and they provide the ‘Ecosystem Services’ that sustain human existence.

The European Honey Bee (*Apis mellifera*), is an important organism within any ecosystem.

(a) Describe how the European Honey Bee is able to provide ecosystem services in all the major categories of provisioning, regulating and supporting ecosystems. (3 marks)

(b) Discuss whether bees are a renewable or non-renewable resource given that in many countries bee populations are under threat from the parasitic mite (*Varroa destructor*). (3 marks)
Question 19
A student used an online ecological footprint calculator to determine their individual impact on the planet. After completing the survey, the results showed that the student needs 2.5 planets to sustain their lifestyle.

a) Explain why the concept of the ecological footprint is useful. (2 marks)

b) To further investigate the factors that determine a person's impact, the student decided to change a number of their answers, and observed the effect that this had upon the ecological footprint value given.

Complete the following table to indicate whether the student’s new response would cause an increase or a decrease in the ecological footprint and state a reason for this change. The first response is done for you as an example. (6 marks)

<table>
<thead>
<tr>
<th>Change in Behaviour</th>
<th>Result (Increase or Decrease)</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Move to a European Country</td>
<td>Decrease</td>
<td>More public transport</td>
</tr>
<tr>
<td>Build and maintain a compost heap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase the number of family members staying in the house</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buy a pet dog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spend the next family holiday locally rather than overseas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Question 20

On a recent trip to Tasmania’s central plateau, a bushwalker noticed that in the areas that were burnt out in the bushfires of January 2016, there was a large build up of bright green algae in bodies of water (puddles, small pools and lakes). This was a result of the runoff that occurred after heavy rains that followed the fires.

(a) State the name of the process that leads to a build up of algae in waterways due to increased nutrient runoff. (1 mark)

(b) A scientist investigating the area performed a Biological Oxygen Demand (BOD) test on the water of several water bodies. Predict whether the BOD results are likely to be high or low, and explain your answer. (3 marks)

(c) Describe the aquatic invertebrate diversity in the water bodies as a result of the above process. (1 mark)
Question 21

“The Cove”, is a disturbing TV documentary featuring a community in Japan that captured dolphins for export to various commercial aquariums where the dolphins would be trained for entertainment as shown in the photo below.

Unfortunately, not all the dolphins were exported and those that were surplus to demand were slaughtered for food and sold within the community. Dolphins are the top-carnivore in their ecosystem and blood samples from members of the community that ate dolphins, revealed very high levels of the neurotoxin mercury, about ten times higher than those in the dolphins.

Describe how the mercury is concentrated within the food chain and give the name of this process. (4 marks)

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Question 22

Visible atmospheric pollution can be of two main types. In developing countries, burning of rainforest to create new agricultural land can result in smoke haze, whereas car exhaust fumes often change the colour of the sun in the sky. The pollutants from cars also result in eye irritation due to pollutants dissolving into the water of the eyes. In places where smoke haze is a problem, locals often wear masks to protect their throat and lungs.

(a) State the main pollutant present in smoke, and explain why wearing a mask is an effective measure to combat the effects of this pollutant. (2 marks)

(b) State a pollutant from car exhausts that may lead to eye irritation. (1 mark)

(c) Describe how smog is formed mentioning the role of one other key substance. (2 marks)
Question 23

Recently Tasmanians have witnessed two different strategies to managing energy demand and supply within the state.

I. Flinders Island has developed a local, self-sufficient, Hybrid Energy Hub that uses a combination of wind power and solar panels to reduce the island’s former dependence upon diesel fuel for electricity generation.

II. A cable that links Tasmania to the National Energy Grid enables Tasmania to export a surplus of electricity from its hydro-electric schemes or import electricity, generated from Victorian brown coal, when there is a water shortage.

Compare and contrast the environmental impact of these two alternatives. (6 marks)

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This question paper and any materials associated with this examination (including answer booklets, cover sheets, rough note paper, or information sheets) remain the property of the Office of Tasmanian Assessment, Standards and Certification.
Candidate Instructions

19. You MUST make sure that your responses to the questions in this examination paper will show your achievement in the criterion being assessed.

20. Answer ALL questions. Answers must be written in the spaces provided on the examination paper.

21. You should make sure you answer all parts within each question so that the criterion can be assessed.

22. This examination is 3 hours in length. It is recommended that you spend approximately 36 minutes in total answering the questions in this booklet.

23. The 2018 External Examination Information Sheet for Environmental Science can be used throughout the examination.

24. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on the following criterion taken from the course statement:

**Criterion 8** Apply principles and processes related to ecologically sustainable management of the environment.
The Principles of Sustainable Development are identified as:

1. Intergenerational Equity
2. Intra-generational Equity
3. Ecological Integrity
4. Precautionary Principle
5. Efficient Use of Resources
6. Pricing of Natural Resources

(a) Complete the table below by inserting the number of ONE of the Principles of Sustainability, from the list above, that each of these policies addresses.  

<table>
<thead>
<tr>
<th>Policy</th>
<th>Principle of Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limiting urban sprawl into natural areas</td>
<td></td>
</tr>
<tr>
<td>Housing affordability for first homebuyers and renters</td>
<td></td>
</tr>
<tr>
<td>More public transport to ease road use</td>
<td></td>
</tr>
<tr>
<td>Council planning to protect coastal zones</td>
<td></td>
</tr>
</tbody>
</table>

(b) Comment on the degree to which ONE of these policies promotes sustainability.  

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Question 25

The Gunns Ltd, Tamar Valley Pulp Mill project, to be sited near Georgetown, Tasmania, was abandoned when the company could not secure the funding to build the project. The Tasmanian Government and the local council were in favour of the proposal because they believed it would create jobs in the area. The Australian Federal Government was satisfied that the proposal satisfied the most rigorous environmental standards for water runoff and atmospheric emissions, although this did not satisfy local wine producers who were worried about their wines being tainted by odours from the mill. Local residents were also concerned about the potential smell, the number of wood trucks on the road and the impact upon native forests. Opponents of the project said that the mill should not be built because it did not have a “social license” since more than half of the people in the local area objected to the development.

Explain how the example above illustrates the concept of “triple bottom line accountancy” (social, economic and environmental aspects). (4 marks)
A private company is planning to build a wind farm on Tasmania’s west coast, to supply electricity into the Tasmanian grid, in the migratory path of the endangered Orange-bellied Parrot (*Neophema chrysogaster*).

(a) State ONE essential requirement before this development can proceed. (1 mark)

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(b) State who is responsible for undertaking this step. (1 mark)

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(c) State which level of government (or governments) local, State or Federal must give approval for this development and in which capacity. (2 marks)

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Wind power is promoted as sustainable because it is “clean and green” meaning that it is renewable and it gives off no Greenhouse gas emissions.

(d) Using the Full Cost Pricing Principle, explain what factors need to be included if wind power is to be considered clean and green. (2 marks)

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Question 27

A commentator on Australian and, in particular, Tasmanian Government policy stated that “By almost any measure Tasmania is becoming like a third world economy.”

The term “third world” refers to Less Economically Developed Countries (LEDCs) and these countries often have a greater environmental impact.

Explain why the following trends are barriers to sustainable development in Tasmania. (8 marks)

Falling educational standards

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Increased birth rate

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Lower household income

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An emphasis on extractive industries as a basis for the economy

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Question 28

The Australian National Waste Report 2016 stated:

“In 2014-15 Australia produced about 64 million tonnes of waste, which is equivalent to 2.7 tonnes of waste per capita. Almost 60% of this was recycled.”

However, according to the Australian Plastics Recycling National Report, commissioned by the Australian Government, in 2016–17 the national plastics recycling rate was 11.8%. This is much lower than the overall recycling rate and a fall of 10% from the previous year. Recycling plastic is dependent upon many factors.

Suggest why the amount of plastic currently being recycled in Australia is so low. (5 marks)

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The Great Barrier Reef (GBR) is a system of coral reefs and islands 3 000 km long, stretching down the east coast of Queensland from Cape York in the north to near Bundaberg in the south. The GBR is internationally recognised for its biodiversity. It is a popular tourist destination for Australians and visitors from overseas who come to see the rich diversity of marine life, and stay at the many resorts scattered along its length. Because of its significance the GBR was given UNESCO World Heritage Status in 1981.

Unfortunately the GBR ecosystem is under threat from global warming and ocean acidification due to Greenhouse gas emissions, eutrophication from terrestrial runoff and wastewater from the resorts; as well as an increase in international shipping as Queensland increases its export coal industry. Some scientists predict that the reef ecosystem will collapse completely as a result of these impacts within 20 years.

If the Great Barrier Reef ecosystem collapses completely, discuss whether this would be considered a “Tragedy of the Commons”. (5 marks)

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