

ENVIRONMENTAL SCIENCE AND SOCIETY

(ESS315118)

FEEDBACK FOR STUDENTS AND TEACHERS

GENERAL COMMENTS

The written examination was well received by students and teachers. Most students felt the examination paper was accessible and allowed ample scope for them to demonstrate their knowledge. Teachers appreciated the varying range of complexity in questions from those that assessed basic understanding through to questions that required greater analysis of interrelated concepts, as is the nature of Environmental Science.

In most cases students provided very good answers. Where students performed poorly it was mostly due to inadequate detail in their responses. Students are advised to carefully read the questions, determine exactly what is being asked of them and make connections to the course content they have covered during the year. This should provide scope for students to attempt all questions.

Students can expect questions that have non-routine contexts. These are questions that use geographic areas or scenarios that are not covered in the course content. Students should read these questions carefully and identify exactly what is being asked, and align this with content they have been taught and construct their responses accordingly.

Students are again reminded that the Information Sheet is to be used as a reference to assist them in constructing their responses. Responses that are written word-for-word from the sheet reveal little understanding of the required knowledge, and often yield little, if any, credit. Students should use the information and apply it to the question. It is also advisable for future students to equip themselves with an approved English dictionary, an invaluable asset if terms used in the question challenge their understanding of what is being asked.

WRITTEN EXAMINATION

The following section specifically comments on students' performance. Marking examiners have offered suggested answers to each question, followed by specific comments on aspects such as how the question was assessed, where students gained or lost marks, where they had difficulty in interpreting the question, or where students failed to comprehend what was required to successfully answer the question. The suggested answers are by no means prescriptive. Students providing different but valid answers, were rewarded accordingly as noted by the examiners.

SOLUTIONS AND COMMENTS

SECTION I

QUESTION 1

- a) (i) Humidity (%) (1 mark)
- (ii) Incidence of fire (1 mark)
- b) 1 mark for each of the following observations:
 - Clearly defined statement (not a question)
 - One Independent and Dependent variable
 - Cause and effect relationship/reason between IV and DV
 - Testable and feasible
- c) 1 mark for any of the following comments:
 - The hypothesis is only based off one observation/data point.
 - It is not specific to situation/vegetation (does not mention Australia)
 - What does relatively low humidity actually constitute?

COMMENTS

- a) The majority of students answered this question correctly. Full marks were not given if students simply wrote fire instead of fire incidence.
- b) Answered well by students however examples were required from the hypothesis rather than simply a generic answer.
- c) Answered well.

QUESTION 2

- a) Birds
- b) Any of the following answers were accepted:
 - Ocean Acidification
 - Global warming
 - Coral bleaching
- c) An increase in ocean acidity levels (decreasing pH) increases the extinction rates of corals
(1 mark independent variable, 1 mark dependent variable, 1 mark link/reason).

COMMENTS

- a) Most students correctly identified Birds. Answers that also included Mammals were only given 1/2 marks.
- b) The majority of students answered this question with a valid reason and gained the full mark.
- c) Answers generally identified an independent variable and a dependent variable, however some responses were too simplistic.

QUESTION 3

- a) Transect
- b) Any one of the following techniques: quadrats, random sampling, remote sensing, dredging or benthic sampling.
- c) Any two of the following organisms: worms, crabs, sponges, microscopic organisms, shellfish, bottom dwelling fish, bacteria, plankton.

COMMENTS

- a) Answered well
- b) Most students identified quadrats as a sampling technique. Responses required a specific technique, answers such as survey or sample were only given 1/2 marks.
- c) The majority of students correctly predicted two species. Fish species given needed to be specific to the sea floor (e.g. flounder).

QUESTION 4

The aerial photograph can be divided using a grid into sections (quadrats). Quadrats can then be randomly selected and the number of penguins counted within each quadrat. An average number of penguins per quadrat is calculated and the map/scale is used to determine the actual area (size) of each quadrat and work out the nesting density per m². The data is then extrapolated to estimate the population of penguins breeding at this site.

COMMENTS

Most students were either too simplistic in their answer, or misunderstood the question and therefore did not gain more than 1-2 marks. A common error was students trying to link the photo estimation with a field study survey suggesting that scientists could go to the site and count penguins. Another common response was to simply count all the penguins in the image which only received one mark. Credit was given to students who identified that each nest on the image should be counted as two penguins due to there being a breeding pair associated with each individual nest.

QUESTION 5

- a) The data is of value to current land managers because it forms baseline data for comparison. The current impacts can be determined by comparing new studies with the baseline data. It can be used as part of an ongoing monitoring program (measuring trends and patterns) and correlated to changes in land use. The data can be used to validate measurement techniques or be used as part of conservation wildlife programs to gauge the success of these programs (i.e. changes in population size of endangered species).
- b) 1 mark given for any of the following explanations:
 - New technology is typically more accurate in data collection such as sensors and collection of biological DNA samples.
 - Different reasons may have been used for collecting samples (i.e. different hypothesis) leading to a different focus on what was collected.
 - Natural & man-made changes to ecosystems - climate change, introduced species, habitat destruction, bushfires and floods - can impact the population numbers and biodiversity. This leads to different results.

COMMENTS

- a) Answered well. The majority of responses suggested it could be used as baseline data which could be compared to current data.
- b) A large number of students only received 1/2 a mark for simply writing new technology without any explanation (e.g. use of an example to support their answer). Around 50% of responses focused on there being a natural change in the ecosystem but failed to link it to populations or biodiversity.

QUESTION 6

- a) The container with cotton wool soaked in fresh water is the control group. It is used as a comparison with results from other experimental groups to determine if observed changes occurred because of the salinity levels.
- b) 1 mark given for any of the following explanations:
 - If evaporation occurs, salt would still remain and this would increase/change the overall salinity levels biasing the experiment.
 - Most seeds require moisture for germination and will not germinate if the water evaporates.
 - It could affect the validity of the experiment if different seeds were subject to different water levels
- c) 1/2 mark for stating an experiment feature and 1/2 mark for identifying this feature within the experiment. [1 mark] for explaining why this feature makes this a good experiment. Any three of the following:
 - Ongoing multiple measurements of dependent variable (monitoring taken daily) – provides validity by eliminating errors.
 - Large sample size (batches of 100 seeds) – increases validity and of results by eliminating outliers.
 - Fixed/controlled variables (same technique, equipment, seed type, duration etc.) ensures the observed changes are due solely to the independent variable.
 - Range of experimental treatments (salt levels from 1% - 10%). This tests the independent variable appropriately and determines an optimum level for germination.

- d) Credit was given for any of the following responses:
- Repeating the experiment using fresh seeds and prepared solutions will increase the validity of the conclusions made from the results.
 - Maintaining a constant temperature by placing containers in a regulated environment eliminates uncontrolled variables and ensures observed results can be attributed to changes in the independent variable.
 - Perform the experiment within a closed container to avoid water loss.
- e) 1 – 1.8%
- f) The results need to be field tested. Measure the salinity levels in the natural habitat of Coastal Wattle and compare with experimental data. Look at the current distribution and health of the Coastal Wattle to compare with salt levels in the area.

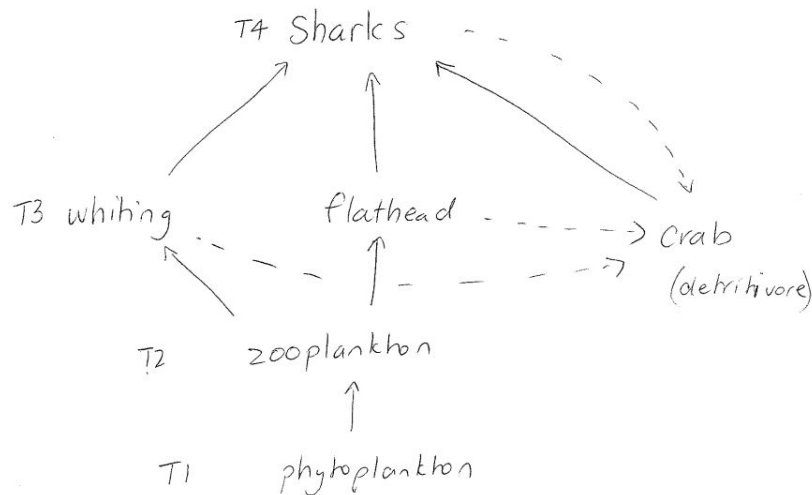
COMMENTS

- a) Students typically answered this question well with a large number gaining 2 marks.
- b) Not answered well. The majority of responses focused on water being a requirement for plants to grow and did not make any link to salinity levels.
- c) Appropriate features were often listed by students, however to gain full marks they needed to give an actual example from within the experiment described.
- d) A large number of students suggested repeating the experiment and provided valid reasons to support this. A common response was to state that the experiment should use soil instead of cotton wool to make it more realistic. This only gained part marks if the candidate did not also mention the implications it would have on the uncontrolled variables.
- e) Answers were too broad suggesting the optimum was from 0 – 2.5 % salinity. Students needed to interpret the graph more carefully and give a precise indication of optimum salinity.
- f) Not answered well. The majority of students chose to explain how repeats could be used or test the experiment again with soil/sand instead of cotton. They needed to link experimental results with actual field site surveys. Some responses received credit for suggesting measuring the predicted sea level rise to see if the wattles would actually be under water.

SECTION 2

QUESTION 7

- a) Marks were awarded for correct order (1 mark) and arrows showing correct energy flow (1 mark). The food web must show the clear distinction between prey and detritivore (1 mark) and all relationships must be represented (1 marks). Trophic levels must be labeled (1 mark).



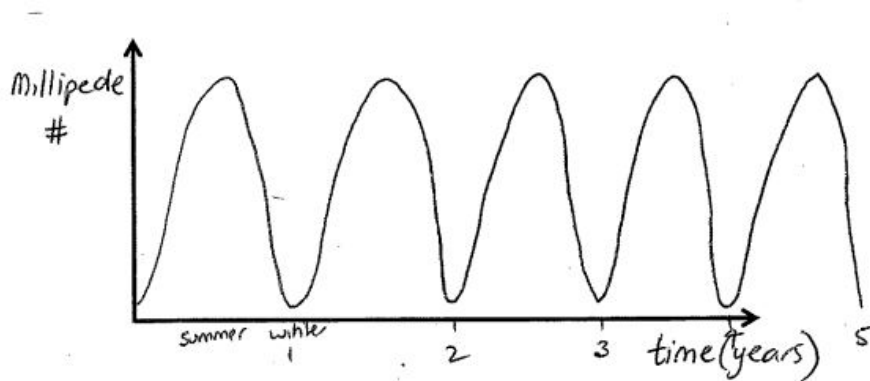
- b) Detritivore/scavenger.
- c) Both whiting and flathead consume the same food source (zooplankton).
- d)
- Sunlight
 - Detritus
- e)
- Fish species population will decrease (1/2) as they are dependent on zooplankton (1/2).
 - Phytoplankton population will increase (1/2) as they are not being consumed by zooplankton (1/2).

COMMENTS

Most parts of this question were generally well answered. Several students forgot to annotate their food web by labeling trophic levels as requested in the question. Note the use of dashed arrow lines to represent the consumption of detritus (dead organisms) by crabs. In part (d) (ii) many students overlooked detritus as a secondary source of energy.

QUESTION 8

- a) Niche is the ecological role (1/2) the millipede plays in the ecosystem (1/2), for example, the millipede is detritivore living in soil.
- b) The Portuguese Millipede has been so successful because it has:
- No predators to regulate its population size.
 - There is little or no competition as it accesses resources not used by other organisms.
 - Food resources are plentiful.
 - It has a high reproductive rate and produces many offspring in each breeding cycle.
- c) Hedgehogs – Biotic, Temperature- abiotic (1/2 each)
- d) Axes must be correctly labeled and graph shape must show significant rise and fall (but not to zero).



- e) Boom and bust cycle or a series of J shaped curves.

COMMENTS

- (a) Many students defined niche but did not relate it to the question at all.
- (b) Most students were able to achieve good marks in this question.
- (c) Well answered.
- (d) Many students had difficulty constructing a graph that represented population changes.
- (e) Very few students correctly identified boom/bust or J shaped cycle. Credit was given for stating 'seasonal cycle' and for similar responses identifying population change.

QUESTION 9

- Positive feedback (1/2) because more heat is absorbed by darker ocean leading to a warmer oceans and more ice melt (1).
- Negative feedback (1/2) because regrowth of forest absorbs CO₂ out of atmosphere and returns it to biomass (1).
- Negative feedback (1/2) because nutrients from decomposition in the compost creates new vegetable growth and surplus vegetable scraps go back into compost (1).
- Positive feedback (1/2) because the situation gets worse as less rain gives more fire prone vegetation so there is more chance of fire (1)

COMMENTS

Students had varied success in this question. Students were able to correctly identify whether the scenario was negative or positive feedback but quite often gave generalised reasons. Specific information related to the scenario was required.

QUESTION 10

- Photosynthesis by plants takes CO₂ out of the atmosphere and releases O₂ (1) for respiration in humans (1). Plants can humidify the air due to evapotranspiration (1).
- A carbon sink is where carbon is trapped and stored for an extended period of time. The CO₂ is incorporated into carbohydrates in plants during photosynthesis. It is stored (within 'wood' cellulose) and taken out of atmosphere for a long time.
- Name (1/2) and outline CO₂ release (1/2) from carbon sinks. Any two of the following:
 - Burning of fossil fuels releases CO₂.
 - Heating limestone during cement production releases CO₂.
 - Warming oceans release CO₂ back into the atmosphere.

COMMENTS

- Very few students made the link between photosynthesis and respiration. Most knew photosynthesis was the key process but many thought CO₂ goes into a plant for photosynthesis and believed another process (i.e. respiration) releases the O₂. Several students thought the air-conditioning idea was about heating/cooling the office and tried to explain properties of CO₂ that might cause cooling/heating.

- b) Most students performed well in this question.
- c) Most students were able to get part or full marks for this questions. Most identified fossil fuel combustion but very few mentioned limestone and cement production. Many identified the ocean as a sink.

SECTION 3

QUESTION 11

Acceptable answers as to why introduced species pose a threat to Tasmanian ecosystems included:

- Introduced species are often generalists, better competitors and have few predators.
- They outcompete local species e.g. seaweed *Undaria* outcompetes local marine algae. It also holds onto large mussels and slows them down.
- Predation of local species e.g. North Pacific Sea Star and the loss of scallops and the Red Fox hunting native animals.
- Introduced species can introduce disease into an ecosystem
- All of the above result in a loss of biodiversity and or degradation to the environment (barrens).

COMMENTS

Most students attempted this question and gained half marks.

2 marks were given for general impacts and 2 marks for the use of examples mentioned.

Several students only used one example and were only awarded one of the two marks.

Several commented on the fact that the Red Fox hunts cows and sheep and marks were not awarded for this.

Some students did not outline the impacts of the introduced species and could not gain full marks.

QUESTION 12

Half a mark was awarded per correct answer.

	During El Nino
Rainfall in Australia	Drought
Rainfall in South America	Flood
Southern Oscillation Index	Decreases
Upwelling of Humbolt Current	Reduced
West Flowing Ocean Circulation Currents	Deeper in the Ocean
Peruvian Fishing Catch	Reduced

COMMENTS

The majority of students attempted this question and many achieved at least half marks.

QUESTION 13

- Summer and low tide are the correct answers. High tide was on occasions selected and given credit provided the reasoning given in part (b) was appropriate.
- Both answers given in part (a) had to be explained to gain three marks. Summer was when the birds would migrate back after breeding to Broome, and therefore the more suitable season to observe maximum numbers. The best time to view the wading birds is also at low tide since they gather on the mudflats to feed on invertebrates exposed when the tide recedes.

COMMENTS

This question was generally well answered and attempted by most students.

- On occasions students did not follow instructions and circled all of the choices given. They were awarded no marks.

- b) Explanations were at times inadequate particularly when explaining why summer was the best season to view the birds.

QUESTION 14

Better answers combined a description of the types of biodiversity and linked this to the information given about the Tasmanian tiger (*Thylacinus cyanocephalus*). Good answers named the types of ecosystem mentioned and pointed out that many of these ecosystems became unsuitable for the Tasmanian tiger to live in over time.

Genetic diversity is the genetic variability within a species and the Tasmanian tiger had very little variability which meant that it was more susceptible to extinction due to disease or climate change.

Species diversity refers to the wide range of single species. Some students noted that a change in species diversity (introduction of the Dingo - *Canis lupus dingo*) on the mainland resulted in the Thylacine becoming extinct there.

Ecosystem diversity refers to a range of different habitats which a species can inhabit. A change in habitat – moist temperate forests adjoining grasslands changing to dry savannah woodland and desert on mainland Australia – contributed to the extinction of the Tasmanian Tiger on the mainland.

COMMENTS

Most students successfully attempted this question. Students that only described three types of biodiversity without linking them to the information given were awarded a maximum of 3 marks.

QUESTION 15

- a) Acidity or alkalinity of a solution are measured using a pH scale. Other acceptable answers included the relative amount of H^+ ions in a solution.
- b) Seawater is becoming more acidic from 8.12 to 8.04 or the pH was decreasing.
- c) Carbon dioxide is dissolved/absorbed in seawater making a solution of carbonic acid. This has increased over time because of an increase in carbon dioxide emissions. Other answers mentioned that the seawater was a carbon sink that absorbed carbon from the atmosphere. Credit was also given to answers that linked an increase in acidity to acid rain or to an increase in sea temperatures.

COMMENTS

- a) It was clear that some students did not understand the term pH and answers often confused pH with salinity.
- b) Some students read a lower pH to mean that it was less acidic.
- c) Too many answers did not describe how a change of pH of seawater comes about. Reasons stated noted that pollution could cause a change in the pH and failed to mention the type of pollution.

QUESTION 16

- a) This forest is not a rainforest because it contains eucalypts and wet sclerophyll species.
- b) A wide range of ages for the forest were accepted varying from 90 to 400 years.
Students needed to justify the age cited.

Reasoning included:

- Mature Eucalypt trees reaching a height of 90metres which would take at least 150 years.
 - Eucalypt trees starting to die and fall over, normally occurring once they are over 200 years of age.
 - Well established understorey of rainforest species that have reached their full height.
 - No evidence of a recent fire including the fact that there was a well-developed rainforest understorey.
 - Lack of Eucalypt saplings in the understorey because rainforest species provide too much shade and competition for Eucalypt seeds to germinate.
- c) There were numerous possible answers for this question and some of these included:
 - A hole in the canopy provided by the death of the Eucalypt allows light to reach the forest floor and seedlings of other species can photosynthesis, grow and fill the gaps.
 - Seeds of the same species may germinate at different rates depending on abiotic factors such as; light conditions, the moisture content of the soil, slope and nutrients available.
 - Some trees may have survived the original fire and are therefore older than others of their species.
 - Intraspecific competition resulting in natural selection and survival of the fittest.

COMMENTS

This was one of the least well answered questions in Section 3 for a variety of reasons.

- a) Some students thought the forest was less than 50 years old and did not recognize the time taken for the well-established rainforest understorey to develop or for Eucalypts to reach a height of 90m.
- b) The diagram posed a problem for some in that students who thought that fire had ravaged the area less than 50 years ago. Given the comparative height of the rainforest species this is not plausible. Students needed to provide more than just one reason as to the age of the forest in order to gain full marks. For five marks most students noted all of the answers listed above.
- c) Successful answers recognised that light was a constraint on the growth of a plant species and noted that if parts of the forest floor received more light then seedlings of the same species could photosynthesize and grow to reach maturity. Some students did not read the question carefully and their answers were based on interspecific competition.

QUESTION 17

- a) Climate change due to natural causes resulted in warmer global temperatures.
Or
A warming of ocean currents brought warmer water to Greenland resulting in warmer air temperatures and a larger ice-free area.
- b) Melting of ice from valley glaciers and ice caps releases nutrients which flow into the oceans. This results in the growth of more phytoplankton and an increase in productivity which can support a more complex food web. Fish populations increase because of this phenomenon. Fish also migrate and extend their range north as the sea warms. A change in the ocean currents may also bring larger fish populations.

COMMENTS

- a) Answers were at times not explicit. A full mark was **not** awarded for just stating climate change, students needed to state how it had changed.
- b) Two marks were awarded per explained factor. Students needed to mention both ice caps and valley glaciers to gain full marks.

SECTION 4

QUESTION 18

- (a) Bees provision the ecosystem and humans with food via pollination that increase crop and fruit yields (also provide honey for food). Pollination of trees allows more trees to grow and store carbon thus regulating the climate. Pollination also allows plants to reproduce and producers provide energy (thus support) for the entire ecosystem.
- (b) Renewable resource as populations of bees renew themselves naturally when birth rates exceed death rates, even though we remove honey. With humans impacting the environment, these populations are under stresses from many threats. Beehives are often managed and populations may be supported by importing mite-free hives from other countries (Australian bees are currently not under threat), introducing biological control of mites, enhancing habitats by planting mixed native species (avoiding industrial agriculture's monoculture) and banning neonicotinoid pesticides.

Or

Non-renewable resource as we use the resource the population is not able to naturally renew their numbers as they are under many threats. If bees become extinct the resource is not able to replenish itself, so it is non-renewable.

COMMENTS

- a) One mark was given for each ecosystem service. Only 1/2 mark was awarded if text from the information sheet were written with no other details. Students found the regulating category of ecosystem services the most difficult to explain.
- b) Either renewable or non-renewable was accepted, but three solid points were needed for full marks. The best answers argued for renewable as there are many ways to manage the population so that the threat of extinction is reduced. Most students that had solid points and argued for both, achieved full marks. Students needed to show that they understood the definition of renewable (does not diminish with use) but a definition proper was not required. This question was answered well considering that it was unlikely to have been taught during the year; suggesting that the concept of renewable vs non-renewable is well understood.

QUESTION 19

(a) The ecological footprint measures many aspects of our lifestyle (energy use, consumption of resources, food, waste) to give the amount of productive land we are using on average in planets, or global hectares. The ecological footprint is important as it gives a number, or quantifies our impact, and this raises awareness to make change (1 mark). Examples as to what is measured in Ecological footprints were required for the additional mark.

(b)

Change in Behaviour	Result (Increase or Decrease)	Explanation
Move to a European Country	Decrease	More public transport.
Build and maintain a compost heap	Decrease	Efficient use of resource as nutrients are recycled and saves transport of food.
Increase the number of family members staying in the house	Decrease	Less resources used as more people sharing under one roof so less homes built and less land developed.
Buy a pet dog	Increase	More protein waste and products consumed for luxury of having a pet.
Spend the next family holiday locally rather than overseas	Decrease	Less fossil fuel used especially in plane flight.

COMMENTS

(a) Most students achieved full marks for this question.

(b) 1/2 mark for each increase or decrease and 1 mark for each explanation. Many students used 'increase' for number of family members and were given 1/2 if their explanation was reasonable. Similarly, 'decrease' for having a pet dog with a reasonable explanation was awarded 1/2 mark. This question was answered very well.

QUESTION 20

- (a) Eutrophication
- (b) The BOD is likely to be high as algae blooms provide a huge food source for bacteria/fungi. As these decomposers respire the dissolved oxygen is consumed decreasing it to close to zero (dead zone). BOD by definition is a demand for dissolved oxygen (associated with high levels of organic matter), and there is now a high demand by all the aquatic organisms in the small pool as there is now very little dissolved oxygen available.
- (c) Overall low aquatic invertebrate diversity as the tolerant macroinvertebrates will only survive in the low dissolved oxygen conditions.

COMMENTS

- (a) Generally well answered.
- (b) Most students achieved 2 marks but did not include enough detail for 3 marks.
- (c) This question asked students 'to describe the aquatic invertebrate biodiversity' so more detail than just 'low biodiversity' was expected for 1 mark. 'Low biodiversity' or similar wording was awarded 1/2 mark.

QUESTION 21

Bio-accumulation means that mercury accumulates over an organism's life as it is a persistent pollutant in the environment, doesn't biodegrade, cannot be excreted, and is stored in the organism's fat cells. Biomagnification means the mercury concentrations increase up the trophic levels of a food web as the lowest trophic level consumes a small dose, but all of the mercury is consumed by its predator. The 10% rule means that energy is lost at each trophic levels, but the mercury remains in the biomass (fat cells) and is passed on to its predator.

Organisms will consume many individuals from lower trophic levels to meet their energy demands, in doing so they magnify the mercury. Top-level consumer (humans) gains the greatest concentration (may be 10000 times greater than the concentration in the water) and when mercury reaches a certain concentration, this triggers diseases and eventually death.

COMMENTS

Unfortunately this question was answered with a lot of words but little detail. Most students achieved only 2 marks as they did not include enough detail for 4 marks. Some specific words were

needed and these are underlined in the answer above. The 10% rule accounts for energy loss and the toxin biomagnifies and increases in concentration at different rates up trophic levels. The variation is due to different concentrations found within various prey species, for example, a raptor predator may eat fish (that contains the toxin) as well as rodents (due to their different ecosystems do not contain the toxin). As dolphins have a large range, they eat many species from different environments and so the levels of toxins they ingest vary. Wording of the question led weaker students to describe biomagnification only, as the question asked for 'the name of this process' (singular). Students should use all the space provided and pay close attention to the number of marks allocated to the question.

QUESTION 22

- (a) The best response is particulate matter, either $PM_{2.5}$ or PM_{10} was accepted, and the filter in the mask is able to filter out the particles so they do not enter lungs and harm our respiratory system.
- (b) Pollutants that cause eye irritation are: CO carbon monoxide, VOC volatile organic compounds, NO_x Nitrogen Oxides, SO_2 sulphur dioxide, and O_3 ozone. Only one pollutant needs to be identified.
- (c) There are two types of smog – sulphurous smog (may simply be called 'smog' or London Smog) and photochemical smog. Both were given marks although almost all students did not answer 'the role of one other key substance' and were only awarded 1 mark.

Sulphurous smog is from the combination of high amounts of SO_2 sulphur dioxide and particulate matter and moisture and is created in winter months often early in the morning. It is associated with coal burning and is thought to originate from the words 'smoke and fog'. The essential requirement of SO_2 or moisture as the other key substance was awarded 1 mark. Gaseous sulphuric acid condenses onto the particulate matter (like a nuclei) and liquid sulphuric acid (acid rain) is formed and mixes with particles to form a thick grey haze close to the ground.

Photochemical smog forms primarily as a result of chemical interactions among nitrogen oxides ($NO_x = NO + NO_2$), reactive hydrocarbons (primarily from industrial and vehicular emissions) and sunlight. The essential other key substance (different from students' answer to part 'b') was any of UV light, sunlight, hydrocarbons, VOCs, oxygen, and nitrogen oxides NO_x .

for 1 mark. UV Light is essential to provide the energy to break apart nitrogen bonds, thus the orangey-brown haze of photochemical smog is a daytime phenomenon. Note: O₃ (ozone) is one of the resulting chemicals in Photochemical smog, so was not given any marks as a key substance leading to smog.

COMMENTS

- (a) This question was answered poorly. Pollutants present in smoke from trees: particulate matter, CO₂ carbon dioxide, N₂O nitrous oxide, CH₄ methane, NO_x nitrogen oxides, VOC volatile organic compounds and CO carbon monoxide. Most students did not know this and a range of gases were given as answers. If the gas was on the list above it was awarded 1/2 mark. No further marks were given as most students then suggested that this 'gas' is removed in the filter of a mask. For example; CO₂ is removed using a filter in a facial mask and thus lungs/throat are protected – this is simply not true. CO₂ is in the air we breathe.
- (b) Students needed to read the wording in the question carefully to realise the question was asking about car exhausts only. Particulate matter and hydrocarbons are also released from car exhausts but they do not cause eye irritation and were awarded no marks.
- (c) This question was answered surprisingly poorly as page 16 of the information sheet provided a great deal of help.

QUESTION 23

Flinders Island	Tasmania
Both renewable energy sources so this creates decreasing GHG emissions once operating	Renewable source of energy so decreasing GHG emissions; unless coal is used in times of drought then much increasing GHG emissions
Island is self-sufficient, this may encourage conservation of energy so environmental impacts will be decreased	<p>Mostly self-sufficient but may depend on grid so GHG emissions are increasing</p> <p>If exporting hydro power to mainland this will decrease GHG emissions for mainland</p>
<p>Less environmental impacts from solar and wind after construction but construction will have impacts:</p> <ul style="list-style-type: none"> - Loss of habitat if cleared for wind or solar farm (possible impacts to threatened species) - Building of roads for construction and maintenance will remove habitats for both wind and solar - Emissions from materials used in construction of both solar and wind - Agricultural land (grazing) is often compatible with wind turbines so the environmental impact of wind turbines on this land is increasing. 	<p>Environmental impacts from dam construction is considerable:</p> <ul style="list-style-type: none"> - Altered flow of catchment - Flood great amount of habitats - Dams are native fish barriers - Lower biodiversity of aquatic species in dam/reservoir - Flooded vegetation and silt will decompose and emit increasing amounts of GHG methane, N₂O nitrous oxide and CO₂ - Loss of high conservation values e.g. Lake Pedder beach - Emissions from materials used in construction - Environmental impacts of coal fired generating station are very high: <ul style="list-style-type: none"> - Mine tailings and dust are toxic - Open cut mines cause loss of habitat - Great amounts of water used in processing

	<ul style="list-style-type: none"> - Emissions from coal excavation, processing and transport - Emissions from materials used in construction of coal - Environmental impacts of cable: - Emissions from materials used in the construction and maintenance - Loss of habitat and disturbance to marine environment
<p>Impacts of eagles and other birds colliding with operational wind turbines</p>	<ul style="list-style-type: none"> - Operational impact of burning coal: - Pollution and GHG emissions from combustion of coal is increasing - Continuing demand to mine and process coal increasing GHG emissions - Acid rain formed by sulphur in dirty brown coal emissions in Victoria

COMMENTS

For full marks, answers were expected to relate to environmental impacts rather than other details. Six briefly described points were awarded full marks. If compare and contrast were not mentioned then a total of 5 marks were not possible. The strongest answers used headings and were very clear by splitting the page into two columns.

SECTION 5

QUESTION 24

(a)

Policy	Principle of Sustainability
1 Limiting urban sprawl into natural areas	3, (4 or 1)
2 Housing affordability for first homebuyers and renters	2
3 More public transport to ease road use	5
4 Council planning to protect coastal areas	(3 or 1)

(b) Possible answers for each policy given below in brief. Students needed to demonstrate their understanding of the principle identified within the context of the policy.

- Ecological Integrity – Increase Biodiversity + Natural Systems remain intact. Natural Capital.
- Intragenerational Equity – less poverty and less people taking environmental “shortcuts” for cost reasons.
- Efficiency resource use – means the resource lasts longer and are shared more easily so the impact decreases.
- Precautionary Principle – stops actions that are possibly harmful thus increasing.
- Sustainability.

COMMENTS

This question was generally well answered by students, but some more expansive thinking would be encouraged to relate the sustainability principle more directly to the policy that was being discussed. In too many instances students did not do this.

QUESTION 25

Triple bottom line accountancy means for a project to be viable it must uphold social, economic and environmental criteria. The pulp mill project did not do this.

While the pulp mill would provide jobs for the local community - a much needed economic injection - it failed to secure bank funding and was therefore economically unviable. Local wine growers were also worried they would be impacted economically by odours tainting their product.

While scrutiny by the federal government satisfied standards for atmospheric emissions and water runoff, the community were worried about air pollution and the impact of wood trucks on roads and increased logging of forests. These potential environmental and social impacts of the mill were not accepted by the community; the mill failed to gain social license.

The failure in meeting all three criteria led to the abandonment of the mill.

COMMENTS

This question was generally well answered with most students being able to secure half marks at least. Many students said the mill was economically viable because it provided jobs but didn't make the link between it not being viable because funding was not secured. Better answers linked the issues identified in the question to the concept of triple bottom line accountancy to explain why the mill was abandoned.

QUESTION 26

- (a) EIA / Baseline study
- (b) The proponent / private company / developer
- (c) Local – application would need to be made to the council as this may require land use changes which is the responsibility of the council. Development applications are also lodged with the councils first.

State – Threatened Species Protection Act – may come into play regarding the Orange-Bellied Parrot and Wedge Tailed Eagle.

Federal – as the EBPC Act lists the Orange-Bellied Parrot as Critically Endangered and Wedge Tailed Eagle as Endangered.

Reference to two levels of government needed to be made if answers were brief or one if answer was very detailed.

- (d) The energy involved in making the components, transporting them and assembly. Hopefully the wind generates / create enough electricity to cover this “cost” and pay for themselves in emissions saved.

COMMENTS

This question was well done with most students answering parts (a), (b) and (c). Part (d) proved to be problematic for some students.

QUESTION 27

Falling education standards

A less educated population means that as consumers they make less informed choices and often less responsible behaviours that may have a great impact on the environment.

Increased birth rate

Causes an increase in population which leads to a greater demand on finite resources. Greater population means reduced opportunities for education and employment and this promotes a poverty cycle that can lead to a greater impact on the environment.

Lower household income

Less money means that as consumers of products and services people will opt for cheaper solutions that are not always sustainable. For example, choosing imported furniture manufactured from unsustainable managed rainforests because it is cheaper than locally made furniture using timber was well managed Tasmanian forests. People may also consume cheaper processed food that is less nutritious and healthy.

An emphasis on extractive industries as a basis for the economy

There is a reliance on extracting mineral and timber resources and selling them as raw products to support the economy. There is less education of workers and downstream processing to product higher value goods that would create wealth.

COMMENTS

Responses to this question showed a range of understanding as to what is meant by sustainable development. Sustainable development means economic, environmental and social sustainability, not just one over the other two. Some good responses were given for the first three trends. There was a lack of understanding on extractive industries in the fourth trend with many students claiming that it is non-renewable and often citing mining as their example. Extractive industries are those that use resources from the environment and can be both renewable and non-renewable. Examples include: minerals, timber products, fish and energy.

QUESTION 28

There are many possible reasons for low plastic recycling in Australia. Marks were awarded to students who explained five of the following reasons:

- Plastics contaminated with food are harder and more costly to process so are avoided.
- There are many different types of plastics that go into recycling, they can be difficult to sort requiring more time and money in the process.
- Low incentive to recycle as the manufacture of new plastics is cheap and easy.
- Lack of education within the community that plastics can be recycled or the impact plastic waste is causing.
- Public laziness – it is easier to use a single-use plastic cup than bring your own reusable one and wash it.
- Limited plastic processing facilities in Australia means lower recycling rates.
- Lack of economic disincentives for using single use plastics means greater consumption (e.g. tax on catering items that is passed onto the consumer, increasing price and discouraging use by hospitality providers).
- Lack of economic incentives for waste management authorities to recycle plastics (e.g. tax rebates and subsidies for companies to reduce the cost of recycling).
- Deposit refund schemes (economic incentive) are not in place Australia-wide.
- Insufficient legislation mandating compulsory recycling.
- Insufficient waste management segregation (i.e. mainstream waste and recycling bins) in public spaces.
- Lack of funding to develop new technology to reduce cost and efficiency of recycling.

COMMENTS

This question provided plenty of scope for students to demonstrate their knowledge of strategies for sustainable management to suggest reasons for low rates of plastic recycling and, as such, most students performed well in this question. Students needed to be careful to suggest reasons for low recycling and differentiate these from reducing and reusing plastics.

QUESTION 29

Definition of Tragedy of the Commons - resources are overexploited or damaged by users for self-interest, with no one singular body responsible for the damage and no collective responsibility. A Tragedy of the Commons can occur when resources are open access with no regulation.

Ecological damage is never paid for or accounted for. There is therefore no recourse for repairing, redressing overuse/damage to the reef.

Whether collapse of the Great Barrier Reef is a Tragedy of the Commons can be argued either way.

If Yes – it is a common.

Ecological damage due to ecosystem imbalance caused:

Indirectly through human impact – greenhouse gases – leading to global warming and ocean acidification contributing to increased coral bleaching events, OR

Directly through

- runoff leading to eutrophication
- increased shipping
- decreased biodiversity

World Heritage Convention – international significant so belong to the world community so could be thought of as a “Common” but managed by range of government levels – Commonwealth / State / Local and administration makes management difficult overall

Cost – Directly as collapse

- decreasing tourism
- decreasing economy

Indirectly – who pays for the run off and ecological damage?

No – not a common – some students provided the following suggestions:

- Activity around the reef not directly using the reef as a resource (i.e. not taking it away).
- Tragedy of the commons relate directly to the use of the common not the pressure placed on it by human impact.
- Private companies own islands/resorts and are regulated for access/numbers using the reef and treatment of waste, therefore not as common as access is regulated.
- Sustainable practices involved.

For full marks – some discussion of what is meant by “Tragedy of the Commons” had to be included in the answer, plus an integrated answer as to how the damage occurred.

EXAMINERS COMMENTS

This question proved to be a challenge for many students as many stated it was a tragedy but did not explain what that meant or how that came about. Students tended to repeat the information in the question but some integration as to how these impacts would lead to the collapse was required to gain higher marks.