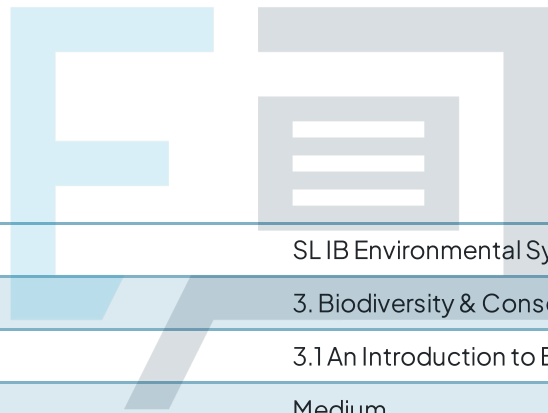




3.1 An Introduction to Biodiversity

Mark Schemes



Course	SL IB Environmental Systems & Societies (ESS)
Section	3. Biodiversity & Conservation
Topic	3.1 An Introduction to Biodiversity
Difficulty	Medium

Exam Papers Practice

To be used by all students preparing for
SL IB Environmental Systems & Societies (ESS)
Students of other boards may also find this useful

1a

Indicative Content	Commentary
<p><i>The non-human factors contributing to the overall biodiversity of an ecosystem include:</i></p> <p>Any four from the following:</p> <ul style="list-style-type: none"> • Biodiversity encompasses the diversity of <u>species</u>, <u>habitats</u>, and <u>genes</u> within an ecosystem; [1 mark] • Species diversity involves both the variety/number of different species present / species richness and their relative abundances / proportions / species evenness; [1 mark] • Habitat diversity refers to the variety of distinct habitats within an ecosystem/biome; [1 mark] • (These diverse habitats may arise due to) environmental gradients / changing abiotic conditions/altitude/latitude / major disturbances e.g. volcanic activity / landslides; [1 mark] • Greater habitat/niche diversity increases species diversity as it creates opportunities for species specialisation / adaptation; [1 mark] • Genetic diversity refers to the variety of genetic material / genes found within populations/species; [1 mark] 	<p>Non-human factors that contribute to the overall biodiversity of an ecosystem include a wide range of environmental and ecological variables. These factors play a crucial role in shaping the composition and distribution of species within an ecosystem.</p> <p>You could gain marks for this question by describing a specific biodiverse ecosystem, such as a climax community or tropical biodiversity hotspot (e.g. the rainforests of Borneo)</p> <p>Just make sure you still refer to the specific factors outlined in the mark scheme above</p> <p>You would not gain marks for including any human impacts on biodiversity or by describing any factors that reduce biodiversity</p>

- (Genetic diversity may arise due to) mutation / sexual reproduction / natural selection / speciation processes; [1 mark]
- High primary productivity / (high/suitable) insolation/sunlight) / (high/suitable) precipitation / optimal abiotic conditions promote biodiversity within ecosystems; [1 mark]
- Succession / ecological change over time contributes to greater biodiversity by lengthening/branching food chains / providing improved abiotic conditions for (various) species; [1 mark]

1b

Indicative Content	Commentary
<p><i>Species diversity and species richness can be compared and contrasted as follows:</i></p> <ul style="list-style-type: none"> • Both species richness and species diversity provide a measure / estimate of the number of different species (in a community/area/ecosystem); [1 mark] • Species diversity takes into account the abundance of species / relative proportions, whereas species richness does not; [1 mark] 	<p>Species diversity is more commonly used in biological and ecological research as it takes into account not only the number of different species but also the number of individuals of each of those species</p> <p>Species richness doesn't always reveal the full picture - for example, a forest could have only two or three species of trees and so would have a low species richness value</p> <p>However, there could be hundreds of individuals for each tree species!</p>

2

Indicative Content	Commentary
<p><i>i) In the last 10 years:</i></p> <ul style="list-style-type: none"> The number of farmland birds has decreased for both farms X and Y; [1 mark] There has been a <u>greater</u> decline/reduction/decrease in the number of farmland birds for farm Y; [1 mark] <p><i>ii) The removal of hedgerows results in the:</i></p> <p>Any two from the following:</p> <ul style="list-style-type: none"> Removal of species OR a reduction in the number of different types of plants/insects OR a reduction in insect/plant diversity; [1 mark] (Meaning there are) fewer food sources / less variety of food / removes a food source; [1 mark] (Resulting in) fewer habitats / niches; [1 mark] <p><i>iii) Organic farming would:</i></p> <ul style="list-style-type: none"> Increase the number of farmland birds; [1 mark] As there would be more insects/pollinators available for the birds to eat / feed on; [1 mark] 	<p>For part (ii) is not sufficient to say there will be "less food" available for the farmland birds</p> <p>You must specify that the number of different types or the variety of food sources decreases</p> <p>This is because different food sources allow for different niches, whereas an increased volume of the same food source does not open up a new niche</p> <p>Without the use of chemical insecticides, the number of insects is likely to increase</p> <p>Insects are a major food source for farmland birds</p> <p>A more plentiful food source will allow more farmland birds to survive and reproduce</p>

3a

Indicative Content	Commentary
<p><i>Species diversity and genetic diversity can be distinguished as follows:</i></p> <p>Any two from the following:</p> <ul style="list-style-type: none"> Species diversity is the number (and relative abundance) of species per unit area / in a given area, whereas genetic diversity is the genetic richness / variability of genetic material in a given area; [1 mark] Species diversity involves / refers to multiple species / more than one species, whereas genetic diversity can refer to a single species/population / individuals within a species or multiple species/populations; [1 mark] A large number of different species / high species diversity implies high genetic diversity, whereas high genetic diversity does not always imply high species diversity / could just refer to a single species; [1 mark] Species diversity is often measured/assessed using metrics like species richness (total number of species present) and species evenness (relative abundance of each species), whereas genetic diversity is 	<p>The command word 'distinguish' requires you to make clear the differences between two or more concepts or items</p> <p>Whenever you are asked to contrast or distinguish between two approaches, a good technique is to use the word 'whereas' in the middle of each of your contrasting points, to demonstrate to the examiner that you are directly contrasting one approach with the other</p> <p>Species diversity and genetic diversity are both essential components of biodiversity, providing different perspectives on the complexity and health of an ecosystem</p> <p>Understanding both species diversity and genetic diversity is crucial for effective conservation and management strategies, as both these aspects offer complementary information on the ecological dynamics and evolutionary potential of an ecosystem</p>

<p>measured/assessed by the variety of different alleles / genetic traits within a population/species; [1 mark]</p>	
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3b

Indicative Content	Commentary
<p><i>i) The species diversity of the grassy meadow will be:</i></p> <ul style="list-style-type: none"> Higher / greater; [1 mark] Because more species are present / species diversity / richness is higher OR because there are more plant species / plant-based food sources; [1 mark] 	<p>Make sure your answers refer to the number of species and not the total number of organisms at the site</p> <p>It would be wrong to assume that fewer organisms in total means lower biodiversity</p> <p>Remember - the command word evaluate means you need to acknowledge both sides of the</p>
<p><i>ii) The statement can be evaluated as follows:</i></p> <p>One mark "for":</p> <ul style="list-style-type: none"> The data / evidence (from the table) supports the statement; [1 mark] <p>One mark "against":</p> <ul style="list-style-type: none"> There are limitations to the data as only one type of habitat has been compared with the farmed field OR only insect species have been counted / other plant/animal species should be counted; [1 mark] 	<p>argument</p>

4a

Indicative Content	Commentary
<p><i>Fertiliser contaminating the stream could explain the conservationist's findings in the following ways:</i></p> <p>Any pair from the following:</p> <ul style="list-style-type: none"> • <i>Suggestion 1:</i> The presence of fertiliser causes eutrophication / oxygen depletion / toxicity / death; [1 mark] • <i>Explanation 1:</i> Which prevents several / many <u>species</u> from colonising / reproducing / surviving / only a few <u>species</u> survive as a result; [1 mark] <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> • <i>Suggestion 2:</i> Fertiliser acts as a food source for some <u>plant species</u>; [1 mark] • <i>Explanation 2:</i> Only those species increase in number; [1 mark] 	<p>Fertiliser can have major negative impacts on streams and rivers as they cause algal blooms and oxygen depletion</p> <p>This makes the living conditions very harsh and only a few species can survive in them</p> <p>The introduction of fertilizer runoff into the stream can lead to eutrophication, which alters the ecological conditions, promotes the growth of specific organisms (such as algae and aquatic plants), reduces oxygen levels, and leads to competitive exclusion.</p>

4b

Indicative Content	Commentary
<p><i>i) As the conservationist moves further away from the farm the index of diversity will:</i></p> <ul style="list-style-type: none"> • Increase; [1 mark] 	<p>As the fertiliser is more diluted the conditions will become less harsh / more favourable for a wider range of species to survive</p>



- As the fertiliser will be (more) diluted further from the farm; [1 mark]

ii) Taking a large number of samples:

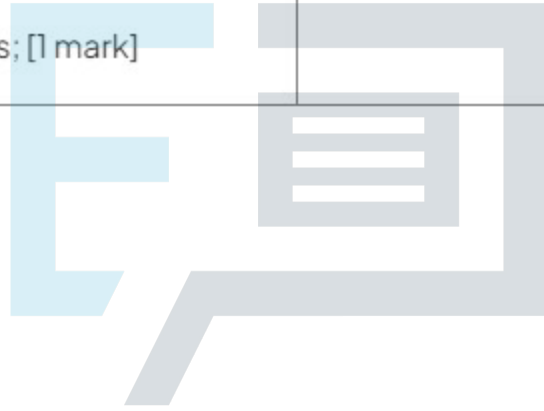
- Produces a more reliable mean / average **OR** makes sure that the samples are representative **OR** reduces the effect of extreme values / anomalies; [1 mark]

Random sampling:

- Removes bias; [1 mark]

For part (ii), make sure you have addressed both marking points here

The question refers to the importance of large sample sizes **and** random sampling



Exam Papers Practice