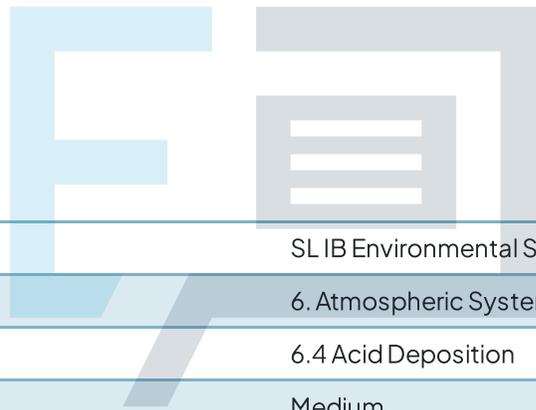




6.4 Acid Deposition

Mark Schemes



Course	SL IB Environmental Systems & Societies (ESS)
Section	6. Atmospheric Systems & Societies
Topic	6.4 Acid Deposition
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

1

Indicative Content

Fossil fuel combustion can lead to acid deposition via the following processes:

Any **three** from the following:

- Combustion/burning of fossil fuels leads to the emission of sulphur dioxide (SO_2); [1 mark]
- And nitrogen oxides (NO_x); [1 mark]
- Which are produced as byproducts of combustion due to the presence of sulphur / nitrogen compounds in fossil fuels; [1 mark]
- These compounds / SO_2 / NO_x can be transported over long distances by wind before being deposited (onto the Earth's surface); [1 mark]
- SO_2 / NO_x can undergo dry deposition, directly settling on the ground/surfaces as sulphates / nitrates; [1 mark]
- Rainwater can combine with SO_2 / NO_x to form sulphuric acid (H_2SO_4) / nitric acid (HNO_3); [1 mark]
- These acids are then (carried by rain and) deposited on the ground/surfaces as wet deposition; [1 mark]

2

Indicative Content	Commentary
<p>Acid deposition, caused by SO_2 and NO_x, can have the following negative effects on terrestrial ecosystems:</p> <p>Any three from the following:</p> <ul style="list-style-type: none"> • (Acid deposition) lowers the pH of soils, which can leach essential nutrients e.g. calcium/magnesium/potassium 	<p>Careful - the question asks you to explain how acid deposition specifically affects terrestrial ecosystems, so any points in your answers that relate to aquatic systems will not gain marks</p>



<p>from the soil, affecting plant health/growth OR can decrease nutrient levels/fertility in soils OR acidification can alter nutrient cycling in soils, affecting the availability/balance of nutrients essential for plant/microbial communities; [1 mark]</p> <ul style="list-style-type: none">• (Acid deposition/acidification of soils) can cause the release of toxic metals e.g. aluminium from the soil, making them more available to plants and potentially harming their roots OR can cause damage to tree roots; [1 mark]• Acidic conditions can negatively impact soil organisms like earthworms/other microorganisms, disrupting ecosystem functioning and affecting biodiversity; [1 mark]• (Acid deposition) can create acid fogs and lead to a decrease in foliage/canopy density as the overall health of the tree declines; [1 mark]• The ability of terrestrial vegetation/plants to cope with stress / demanding abiotic/biotic factors e.g. frost/drought/pests/diseases is decreased (due to acid deposition); [1 mark]	
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Indicative Content

The influence of pollutants such as sulphur dioxide and nitrogen oxides on an ecosystem can be measured using the following indirect methods:

Any **three** marking points from **one** of the following sets of answers:

- Use of a biotic index to assess the relative abundance of organisms / monitor presence-absence of organisms; [1 mark]
- Different organisms show varying tolerances to different conditions / different species display varying levels of sensitivity to pollution; [1 mark]
- Identifying/quantifying organisms at a location offers insights into the environmental conditions; [1 mark]
- Calculation of a biotic index involves assigning values to organisms based on their tolerance; [1 mark]
- Higher index values indicate healthier conditions, while lower values suggest pollution impact; [1 mark]

OR

- Utilising measurements of species diversity; [1 mark]
- Collecting data on species richness/abundance under standardised/consistent conditions over a set time span; [1 mark]
- Then comparing outcomes/species diversity across different sites / time periods; [1 mark]
- Use of / surveying of /data collection for indicator species; [1 mark]
- A decrease in diversity can indicate pollution-induced stress on an ecosystem; [1 mark]

OR

- Organisms display differing sensitivities to varying pollution levels; [1 mark]
- E.g. reduced presence of lichens in proximity to industrial zones; [1 mark]
- Lichens are sensitive to air pollutants (especially sulphur dioxide); [1 mark]

- Their decline suggests poor air quality in industrialised areas; [1 mark]
- E.g. occurrence of tar spots on sycamore leaves in rural regions; [1 mark]
- Tar spots result from fungal infections that thrive in nitrogen-rich environments; [1 mark]
- Higher occurrences indicate higher nitrogen oxide levels due to pollution; [1 mark]

4a

Indicative Content

Advancements in technology that have led to the reduction of transport emissions of sulphur dioxide and nitrogen oxides include:

Any **one** of the following sets of answers:

- Implementation of catalytic converters in a broad(er) range of vehicles; [1 mark]
- Converts harmful exhaust gases into less harmful substances / particularly effective in reducing nitrogen oxide emissions; [1 mark]

OR

- Adoption of low sulphur diesel fuels; [1 mark]
- Results in fewer sulphur dioxide emissions / limits the environmental impact of combustion processes; [1 mark]

OR

- Enhanced vehicle designs/efficiencies; [1 mark]
- Improved aerodynamics / more efficient engines / decreases overall emissions of SO_2 / NO_x ; [1 mark]

OR

- Emergence of alternative vehicle technologies; [1 mark]
- Introduction of electric/hybrid/hydrogen-powered vehicles / these options produce minimal/no direct SO_2 / NO_x emissions; [1 mark]

4b

Indicative Content

Alterations in human behaviour that have led to the reduction of transport emissions of sulphur dioxide and nitrogen oxides include:

Any **one** of the following sets of answers:

- Increased fuel prices; [1 mark]
- Encourages individuals to seek fuel-efficient options / drive less; [1 mark]

OR

- Greater reliance on public transportation; [1 mark]
- Reduced use of individual vehicles lessens overall emissions; [1 mark]

OR

- Changes in taxation to address/target vehicle use; [1 mark]
- Modified vehicle taxes can act as disincentives for excessive driving; [1 mark]

OR

- Government policies favouring public transport/reducing unnecessary travel; [1 mark]
- Promotes the use of more environmentally friendly transportation options; [1 mark]

OR

- Heightened public awareness; [1 mark]
- Increased consciousness of environmental issues influences behaviour; [1 mark]

OR

- Carpooling initiatives/apps; [1 mark]
- Sharing rides decreases the number of vehicles on the road, lowering emissions, and is cheaper for users; [1 mark]



OR

- Uptake in cycling/walking; [1 mark]
- Non-motorised modes of transport lead to decreased emissions / have added health benefits; [1 mark]



Exam Papers Practice