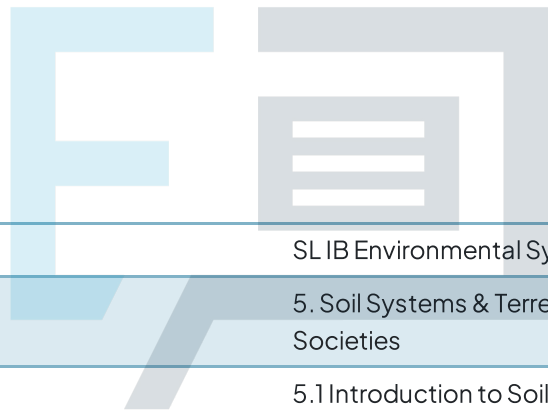




5.1 Introduction to Soil Systems

Mark Schemes



Course	SL IB Environmental Systems & Societies (ESS)
Section	5. Soil Systems & Terrestrial Food Production Systems & Societies
Topic	5.1 Introduction to Soil Systems
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

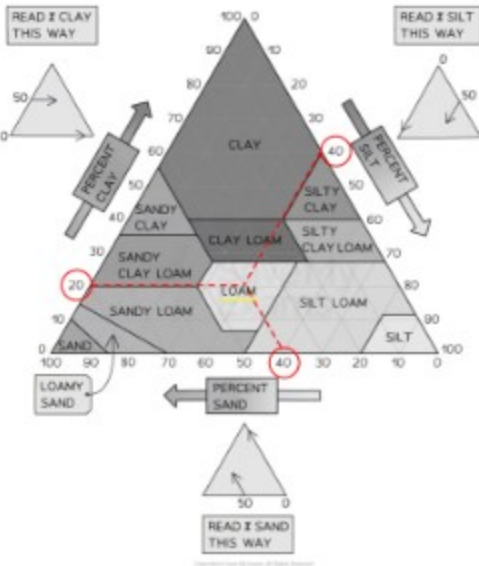
Indicative Content	Commentary
<p>Examples of transformation processes occurring within soil systems include:</p> <p>Any two from the following:</p> <ul style="list-style-type: none"> • Decomposition (of organic matter) OR organic matter breakdown by microorganisms; [1 mark] • Humus formation OR humification of organic matter; [1 mark] • Oxidation OR oxidation/reduction of minerals OR rusting soil; [1 mark] • Mineralisation OR the nutrients in chemical compounds (in organic matter) are released in soluble inorganic forms available to plants; [1 mark] • Fixation of N/nitrogen OR nitrification / denitrification / ammonification; [1 mark] • (Chemical) weathering OR weathering of primary minerals/parent rock OR dissolution/dissolving of minerals from rock/soil particles (e.g. reaction between acidic rainwater and limestone); [1 mark] • Nutrient/biogeochemical cycling; [1 mark] • Hydration; [1 mark] • Evaporation; [1 mark] 	<p>Transformations involve a change in the form or quality of matter or energy as it moves through the system</p> <p>For example, when sunlight is absorbed by plants, it is transformed into chemical energy through the process of photosynthesis</p>

1b

Indicative Content	Commentary
<p>Examples of transfer processes occurring within soil systems include:</p> <p>Any two from the following:</p> <ul style="list-style-type: none"> • Infiltration OR water entering the soil from the surface OR downward movement/percolation of water through the soil; [1 mark] • Eluviation OR removal of fine particles/clay/dissolved organic matter from the upper layers of the soil by (the downward movement of) water; [1 mark] • Illuviation OR deposition OR depositing of materials/minerals/organic matter in lower soil layers (as a result of leaching/eluviation processes); [1 mark] • Leaching OR minerals/nutrients/iron/ silica / aluminium compounds dissolved in water moving (downwards/horizontally) through the soil; [1 mark] • Mass movement OR down-slope movement of regolith (loose uncemented mixture of soil/rock particles) due to gravity • Wind-blow of sediment; [1 mark] 	<p>Unlike transformations, transfers involve the movement of matter or energy from one component of the system to another, without any change in form or quality</p> <p>For example, water flowing from a river to a lake is a transfer</p>

- Movement of sediment by ice particles in soil / frost heave / movement by glaciers; [1 mark]
- Uptake (of water/nutrients/minerals) by plants / living organisms; [1 mark]
- Upward movement of salts to surface as the result of evaporation; [1 mark]
- Biological mixing **OR** mixing of organic matter/minerals **OR** movement of soil particles and materials by soil organisms/animals/earthworms; [1 mark]

2a

Indicative Content	Commentary
<p>The classification of Soil B is:</p> <ul style="list-style-type: none"> • Loam; [1 mark] 	<p>Soil texture triangles can be easily misinterpreted - pay close attention to the angle at which you need to take readings from each of the three axes</p> <p>The angle you should use is shown in the diagram opposite</p>

2b

Indicative Content
<p>The soil that would be more suitable for growth of crops is:</p> <ul style="list-style-type: none"> • Soil B; [1 mark] <p>Because it:</p> <p>Any two from the following:</p> <ul style="list-style-type: none"> • Has the optimum combination / balance of sand, silt, and clay; [1 mark] • Is easily workable / has good structure/texture/tilth; [1 mark] • Drains well / has good drainage (properties); [1 mark] • Has many air spaces / good aeration / is well aerated; [1 mark] • Retains moisture/nutrients; [1 mark] • Has good potential/ability to hold organic matter; [1 mark] • Has high water holding capacity; [1 mark] • Has good access to minerals; [1 mark]

3

Indicative Content	Commentary
<p>In a soil profile, the <i>O horizon</i> represents:</p> <p>Any three from the following:</p> <ul style="list-style-type: none"> • The <u>organic</u> horizon/layer; [1 mark] • The surface/uppermost horizon layer; [1 mark] • The horizon/layer composed (mainly) of organic matter e.g. leaf litter / twigs / decaying plant material / organic debris / dead organisms; [1 mark] 	<p>Soil profiles provide a visual representation of the different layers or horizons present in a soil system</p> <p>These horizons reflect the processes and materials that have shaped the soil over time</p> <p>There are six main horizons</p> <ol style="list-style-type: none"> 1. O Horizon (Organic Horizon) 2. A Horizon (Topsoil)

- (A horizon/layer that) is rich in nutrients / serves as a source of energy/nutrients for soil organisms; [1 mark]
- (A horizon/layer that) serves as a site for nutrient cycling / organic material decomposition; [1 mark]
- (A horizon/layer that) plays a vital role in soil fertility / contributes to the formation of humus / improves soil structure / water-holding capacity; [1 mark]

3. **E Horizon (Eluviation Horizon)**
4. **B Horizon (Subsoil)**
5. **C Horizon (Parent Material)**
6. **R Horizon (Bedrock)**

Make sure you learn some of the common materials, soil types, and processes that occur in each of these horizons

4a

Indicative Content

The trend in water content for Soil X as rainfall increases can be described as follows:

- Water content stays (fairly) level/constant until about $2-3 \text{ cm}^3$ of rainfall, then between $2-3 \text{ cm}^3$ and 10 cm^3 the water content starts to increase; [1 mark]
- There is an exponential increase in water content after $2-3 \text{ cm}^3$ of rainfall; [1 mark]

4b

Indicative Content

The table should be completed as follows:

Soil type	Soil X, Soil Y or Soil Z
Loam	Y
Sand	Z
Clay	X

- *3 soils correctly identified; [2 marks]*
- *2 soils correctly identified; [1 mark]*

Exam Papers Practice