Leaving Certificate Higher Level Soil Questions

2010 Question 2

(a) List **four** factors that are responsible for the development of soil structure.

(b) Outline the formation of peat bogs in Ireland

(c) Describe an experiment to estimate the percentage organic matter in a soil sample.

Marking_Scheme2010

2009 Question 2

(a) (i) Outline in reasonable detail why care should be taken in removing soil samples from a field before testing the soil fertility levels.

(ii) What is meant by the term *lime requirement*?

(iii) List the elements found in ground limestone.

(b) (i) Explain *cation exchange*.

(ii) Explain the term *cation exchange capacity* (CEC).

(iii) Mention a soil type where CEC is very low.

(iv) Describe a method by which CEC may be increased in a soil.

(c) Describe a laboratory experiment to test for the presence of phosphates.

Marking_Scheme2009

2008 Question 2

(a) Explain how the weathering of rocks contributes to soil formation.

(b) (i) Explain the following terms as used in the context of plant growth in soil.

1. field capacity 2. permanent wilting point 3. available water

(ii) The following table shows the water content of three soil samples.

1. What is the percentage of available water in sample A?
2. Which sample would be the most suitable for a crop suffering a drought during the growing season?
3. Which sample would be the most suitable for a crop growing during a wet spring?

Soil Sample	% Water at Field Capacity	% Water at Wilting Point
A	6	2
B	24	12
C	30	22

(iii) Describe an experiment to compare the capillarity of two contrasting soils.

Marking_Scheme2008

2007 Question 2

(a) (i) State **two** differences in composition between soil air and atmospheric air.

(ii) Explain how any **one** of the differences you have mentioned occurs.

(b) Describe en experiment which compares the movement of water by capillarity within two contrasting soils.

(c) Explain how each of the following influences the temperature of a soil:

(i) aspect,

(ii) colour,

(iii) water content,

(iv) location.

Marking_Scheme2007

2006 Question 2

(a) Explain why regular liming of land is an important farming operation in Ireland.

(b) List the main steps in the podzolisation of a soil.

(c) Outline the chemical exchanges that would occur in the soil between the lime, soil colloids and soil solution following the application of lime.

(d) Describe the influence of earthworm activity on the structure and development of a soil.

Marking_Scheme2006

2005 Question 2

(a) Explain how each of the following farm operations could affect the population of earthworms in a tillage field:

(i) Soil cultivations

(ii) Spreading farmyard manure.

(b) Give **three** differences between a soil developed under coniferous forest and a soil developed under grassland.

(c) (i) What is cation exchange?

(ii) Describe a laboratory experiment that would demonstrate the phenomenon of cation exchange in a soil.

Marking_Scheme2005

2004 Question 2

(a) The following table shows the analysis of two soils A and B.

	Coarse Sand	Fine Sand	Silt	Clay
Soil A	46%	20%	20%	14%
Soil B	10%	17%	28%	45%

(i) Identify the texture of soil A and soil B.

(ii) Explain how these two soils differ under t he headings of physical properties and chemical properties.

(b) Using a labelled diagram, describe and **named** soil profile.

(c) Explain how soils are influenced during their formation by the following factors:

(i) Parent material

(ii) Climate

(iii) Topography

(iv) Living organisms.

Marking_Scheme2004

2003 Question 2

(a) Explain how flocculation contributes to the development of the structure within a soil.

(b) Cementation and separation are two processes that affect the development of soil structure.

(1) Explain the underlined terms.

(2) State and explain **four** factors that contribute to these two processes.

(c) Describe with the aid of labelled diagrams, an experiment to investigate the structure and texture of any named soil type.

Marking_Scheme2003

2002 Question 2

(a) Explain how soil temperature is influenced by any **three** characteristics.

(b) Describe, with the aid of a labelled diagram, an experiment to investigate a named physical characteristic of a soil.

(c) State **three** factors which influence the length of the grass-growing season in Ireland.

Marking_Scheme2002

2001 Question 2

Soil Type	% Water at Field Capacity	% Water at Wilting Point	Available Water Capacity
Sandy	8	3	
Loam	22	11	
Clay	28	19	

(a) Using the table above answer the following:

(i) Copy the table into your answerbook and complete the blank column.

(ii) Explain which of the above soils would best support crop growth (1) during a drought and (2) in early spring.

(b) Explain the terms (i) field capacity and (ii) permanent wilting point

(c) Describe, with the aid of a diagram, an experiment to compare the drainage of sandy and clay soils.

Marking_Scheme2001

2000 Question 2

(a) Explain how the texture and structure of a soil influences how often it needs to be limed.

(b) Describe a laboratory test to determine the pH of a soil. Explain how an application of lime raises the pH of a soil.

(c) Describe the difference between nitrification and denitrification.

(48 marks)

1999 Question 2

(a) Outline the procedures you would use in the laboratory to compare the structure and composition of samples of soil taken from different locations on a tillage farm.

(b) Describe three beneficial effects of applying a compound containing the element calcium to a soil.

(c) List four factors which influence the drainage and aeration of a soil.

(48 marks)

1998 Question 2

(a) Describe any two factors which may influence two named physical characteristics of a soil.

(b) Mention the principal factors which influence the formation of a loam soil.

(c) Name two major and two minor elements occurring in a soil. Outline a laboratory or field experiment you carried out to show the influence of one major mineral element on plant growth.

(48 marks)

1997 Question 2

(a) Explain how the pH value of soil in a field may be changed.

(b) In the case of a named soil type describe the importance of each of the following:
watertable; capillarity; leaching; field capacity.

(c) Describe the influence of each of the following on soil temperature:
aspect; colour; altitude; water content.

(48 marks)

1996 Question 2

(a) Describe the conditions which contribute to the formation of a podzol.

(b) Explain how any three named environmental factors may contribute to the deterioration of the structure of a soil.

(c) Describe the ways in which nitrogen is supplied, used and re-cycled in a soil.

(48 marks)

2010 Marking Scheme

2. (a) STRUCTURE

Wetting and drying, activity of soil animals-earthworms, freezing and thawing, root activity, tillage operations or detail of (one point), adding lime (limestone), adding organic matter — 4 (4m)

(b) BOGS

Blanket = caused by high local rainfall, usually but not always at altitude/ low evaporation rate

Basin Peat = caused by lake or swamp of stagnant water filling in with moss sphagnum &c

(points can be awarded for correct labelled drawing(s))

Leaching/ acidic conditions/ iron pan/ water-logging/ anaerobic conditions/ absence of bacteria of decay/ build up of organic matter — 4 (4m)

Points on either

(c) EXPT

dry soil sample/ weigh/ place in crucible/ over Bunsen/ pipe clay triangle/ stir/ humus burns red/ red colour is gone (smoke stops)/ reweigh/ formula OR correct alternative chemical experiment/ Loss in wt divided by wt of sample x 100 = % organic matter — Any 4 (4m)

2009 Marking Scheme

2. (a) (i) Field may have been in 2 or more divisions/ wet spots/ dry spots/ old drains/ cropping history unknown/ avoid inside gateways/ avoid headlands/ avoid under trees/ avoid near waterways/ to get an accurate sample/ many samples/ random/ sampling from root zone ('W' given unqualified = 2+2). Any three — 2m+2m+2m

(ii) Amount (of lime needed)/ to overcome buffering or to raise (change) pH or to facilitate absorption of trace elements **or** as the result of a soil test — 2m+2m

(iii) Calcium/ Carbon/ Oxygen (or symbols). Do not accept compound formula. — 2m+2m+2m

(b) (i) Named ion (e.g. calcium; magnesium) replacing another named ion (e.g. hydrogen) — 4m

(ii) Ability of soils to carry out cation exchange or measured in milli-equivalents per 100g colloid. — 4m

(iii) Sandy soil — 4m

(iv) Alter CEC in sand by adding organic matter (or seaweed or slurry or FYM) or green manuring — 4m

(c) Take soil sample/ suitable vessel/ add distilled H_2O/ shake/ filter/ add ammonium molybdate **or** use test kit/ yellow ppt. (= positive for molybdate) or blue (= positive for soil test kit). — Any 4 (4m)

2008 Marking Scheme

2. (a) soil particles originate from rock (compulsory) 3m
sun or freezing water causes rock expansion or cracking/ wind carrying particles causes grinding/ rainwater causes chemical reactions etc. (any correct examples of weathering) 6m+3m+3m

(b) (i) 1. amount of water in soil after water was drained away by gravity 3m
2. all capillary water used/ plant unable to extract more/ plant dies 3m
3. difference between 1 and 2/ water plants can get 3m
(ii) 1. 4% 3m
2. B 3m
3. A 3m

(c) Different samples/ in containers suitable for experiment/ equal (allowed once)/ cotton wool/ placed in water/ left for a period/ rise in water level observed/ result or conclusion 6m+ 3(3m)

2007 Marking Scheme

2. (a) (i) soil air – more carbon dioxide concentration/ less oxygen concentration/ less nitrogen concentration/ difference in water vapour 2 (3m)
(ii) respiration in root/ microbial activity or respiration of soil organisms/ decomposition/ any reference to a process in the nitrogen cycle (e.g. nitrogen fixation) 3m

(b) two samples of different soils/ placed in suitable apparatus/ placed in water/ equal amounts of water/ leave for a period/ method of noting level of water/ measure level of water in samples/ conclusion 5 (3m)

(c) (i) south facing soil/ heats up faster 2 (3m)
(ii) dark soil/ absorbs heat faster 2 (3m)
(iii) wet soil/ is slower to heat or has higher specific heat capacity 2 (3m)
(iv) latitude or height above sea level or proximity to sea or reference to a specific location/ variation in temperature 2 (3m)

2006 **Marking Scheme**

2. (a) Rainfall causes leaching of bases/ liming replenishes calcium ions/ many soils acidic/ liming increases pH/ most crops need neutral soil/ improves structure (flocculation)/ prevents root rot/ increases earthworm activity/ improves drainage/ improves aeration/ helps release (or make available) N, P, K/ increases bacterial activity/ overliming/ resulting negative effect explained — any three — 6m+3m+3m

(b) Acidic parent material/ high rainfall/ leaching (loss of minerals)/ accumulation of iron or aluminium/ formation of iron pan/ water logging/ anaerobic conditions/ accumulation of organic matter (peat) — any three — 6m+3m+3m

(c) Lime ($CaCO_3$ or $MgCO_3$) causes Mg or Ca ions/ to replace H or Al ions on soil colloid/ this leads to reduction of H ion concentration in soil solution/ hence raises soil pH — any three — 6m+3m+3m

(d) Recycle organic matter (adds humus)/ add soil biomass/ improve fertility/ mix soil layers/ improve aeration/ improve drainage/ neutralises soil — any three — 6m+3m+3m

2005 Marking Scheme

2. (a) (i) eases burrowing (reduces compaction)/ direct killing/ exposure to predation/ reduced number of transport channels/ reduces soil biomass or organic matter/ other justified effect — any two — 6m+3m

(ii) adds worms/ food (organic matter) for worms/ benefit from improved soil structure/ other justified effect — any two — 6m+3m

(b) forest soil has more leaching/ is more acidic/ has less organic matter/ less humification/ less water retention/ less nutrient-holding capacity/ has more horizons (opposite effects for grassland) — any three — 6m+ 2(3m)

(c) (i) cations continually leaving surface of colloids to replace ions withdrawn from the wet soil water OR being replaced by other cations that are temporarily more abundant in soil OR calcium replacing other ions — 6m

(ii) small sample of soil/ in filter paper in a funnel/ add reagent slowly/ potassium chloride/ test for calcium/ continue exchange/ repeat Ca test until test is negative/ test for K/ result/ conclusion — any four — 4 (3m)

2004 Marking Scheme

2. (a) (i) texture: A sandy, B clayey — 2m+2m

(ii) two differences under each heading

physical properties: A has better drainage/ A has better aeration/ A easier to till/ A warms up earlier/ B retains water better/ A leaches easier

chemical properties: B has better cation exchange/ B more fertile/ B flocculates/ B has less leaching — any four — 4 (3m)

(b) soil profile **name** 4m

diagram showing horizons 3m

[If diagram does not match named profile then 0 marks for diagram]

labels or description 3 (3m)

(**Letters alone e.g. A, B, C: 3 marks**)

(c) (i) soil texture/ mineral content/ pH/ drainage any one 4m

(ii) glaciation/ physical weathering/ frost/ wind or water causes disintegration/ rain causes chemical weathering/ rainwater causes leaching/ effect of wind any one 4m

(iii) water retention/ vegetation affected by aspect/ soil erosion on hillside/ shallow soil on hillside/ deep soil lower down/ more fertile lower down/ frost action related to altitude any one 4m

(iv) organic parent material/ living organisms contribute nutrients/ type of plant influences soil/ type of vegetation depends on climate and plants cause physical weathering/ acidity of soil depends on vegetation type/ all earthworm activities any one 4m

2003 Marking Scheme

2. (a) *Flocculation*

structural units of soil or peds/ held together by organic or inorganic cements/ cementing particles are colloidal in size/ come together in floccules or clusters/ -ve charges on the cementing particles are satisfied by polyvalent cations/ particles are linked together by bridges of polarised water molecules/ floccules formed/ sand and silt are trapped into the aggregates/ Fe, Al, H, Ca are effective ions and are abundant in Irish soils/ high degree of structural development/ gives rise to better (more fertile) soils/ brings together to form pores/ influences pore size/ influences aeration/ influences drainage/ influences temperature any four 4 (4m)

(b) (1) *Cementation* = particles and cements are pushed closer together

Separation = cemented materials are broken up (or pushed into aggregates or clumps) 2 (2m)

(2) Wetting and drying – drying causes shrinkage, pushes particles together wetting, drying circles causing cracks, break-up of soil mass

Freezing and thawing – swelling and shrinkage, frost tilth formed,

Activity of roots – small roots increase soil and cement contact, large roots crack and break up soil

Activity of earthworms – particles and cement mixed in gut, better structure – Casts, channels left by worms promote cracking and break-up

Tillage operations – promote aggregation, expose large clods, promote drying and shrinkage any four

name of factors 4 (2m)

explanation 4 (1m)

(c) *Named soil type* 1m

Full marks to be awarded for **one** experiment to investigate texture **OR** structure

Diagram = (0m, 3m, 5m)

Points can be found on diagram or written

Method 5 (2m)

1. hand lens/ feel with fingers/ moisten and knead/ note cohesiveness and plasticity/ roll into threads and bend/ use a table of pre-determined information to decide the soil texture <u>any five</u>

   OR

2. place soil in beaker/ add water/ break up and mix/ pour into graduated cylinder/ add water/ allow to sediment/ measure volumes of layers <u>any five</u>

   OR

3. Any valid experiment to investigate texture or structure

<u>2002 Marking Scheme</u>

2. (a) *Three characteristics* 3 (2m)

   1. Moisture level/ water/ drainage
   2. Soil type/ heavy or light/ % clay/ % sand/ soil structure if qualified
   3. Air spaces/ soil air
   4. Soil pH

   Explain - 1 (4m)

   2 (3m)

(b) *Experiment – Any named physical characteristic of soil*

Named physical characteristic 1m

Diagram = (0m, 3m, 5m)

Points can be found on diagram or written

Method – any relevant method for the named example given 5 (2m)

Soil Texture – by feel

Soil samples or named examples/ examine soil with hand lens/ handle soil and note the feel e.g. gritty or non-gritty/ moisten samples with water/ note the cohesiveness and plasticity of soil/ kneed into long threads/ use a table of pre-determined information to decide the soil texture/ repeat for other unknown samples

Soil Texture – by textural class

Use a textural triangle/ known % of clay, sand and silt/ use the triangle to plot %/ lines intersect at the same place = correct result/ conclusion

Soil Texture – by sedimentation

Soil sample/ place in a graduated cylinder/ add water/ stir to mix/ leave to stand/ different particles settle out at different levels/ measure the volumes of the different layers and express as % of total vol. / conclusion

Flocculation of a soil

Clay suspension into each of 4 test-tubes/ reagents HCl, NaCl, CaCl, AlCl/ add reagents to test tubes/ mix/ examine after time intervals/ results/ conclusions

Soil Aeration / % air

Equal Vol. of Soil/ equal vol. of water/ graduated cylinder/ water in cylinder/ soil in cylinder/ shake/ settle/ record vol./ expected – observed = soil air

Soil Water (available)

Weigh vol. of soil/ weigh crucible/ weigh soil and crucible/ oven/ 50^{O}C/ time/ weigh/ reweigh/ same weight for two weighings/ difference = available soil water

Soil Water (unavailable)

Weigh vol. of dry soil/ weigh crucible/ weigh soil and crucible/ oven/ 80^{O}C/ time/ weigh/ weigh/ reweigh/ same weight for two weighings/ difference = unavailable soil water

Soil Permeability

2 graduated cylinders/ funnel with filter paper/ vol. of soil samples, clay and sand/ vol. of water/ pour water on soil samples/ time taken to drain through or vol. drained in x time, result/ sandy better drainage than clay, conclusion

Soil Capillarity

2 open ended glass tubes/ fill one tube with sand or sample A/ fill second tube with clay or sample B/ cotton wool at end/ immerse in beakers of water/ seedling on top of each tube/ leave X time/ observe visually through the glass tube the water movement/ or germination of seeds in the clay sample = water moved/ no germination in sand sample = no water movement

(c) **Three** factors that influence the grass growing season 1 (6m)
2 (5m)

1. Ground/ Soil Temperature
2. Light – day length/ sunshine hours
3. Rainfall/ soil air
4. Soil Type (heavy Vs light)
5. Heavy Grazing in autumn
6. Location
7. Soil air
8. Grass type

2001 Marking Scheme

2. (a) (i) Complete the columns = (sand) 5, / (loam) 11/ clay (9) — 3 (2m)

(ii) (1) support drought = Loam (2) early spring = Sandy — 3m + 3m

Explain = Loam = most available water — 2m

Explain = sand = less water, more air in soil/ air heats faster then water/ quicker to warm up in spring/ a lot of growth in early spring — 2m

(b) *Field capacity* = soil saturated/ excess water present allowed to drain away/ what remains in the pores when the gravitational water has drained away/ amount of water held on and between soil particles (absorbed and capillary water) — 8m

Permanent wilting point = when all capillary water is used/ unable to extract soil water/ loss of too much water/ cannot recover/ plant death — 8m

(c) *Experiment*

Diagram — (0m, 2m, 4m)

2 graduated cylinders/ funnel with filter paper/ vol. of soil samples, clay and sand/ vol. of water/ pour water on soil samples/ time taken to drain through or vol. drained in x time, result/ sandy better drainage than clay, conclusion — any — 3 (4m)

Points can be represented on the diagram