

Leaving Certificate Higher Level Experiment Questions

2010

4. Describe a laboratory or field method to determine any **two** of the following:
- (a) The texture of a sample of wet soil.
 - (b) The number of earthworms in a pasture.
 - (c) The rate of transpiration of a plant.
 - (d) The digestibility of rolled barley versus whole barley when fed to cows.

[Marking_Scheme2010](#)

2009

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The percentage germination of a cereal.
 - (b) The calorific value of a farm animal ration.
 - (c) The effect of a selective herbicide.
 - (d) The presence of bacteria in the root nodules of clover.

[Marking_Scheme2009](#)

2008

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The percentage of sugar in a sample of grass.
 - (b) The influence of any **one** named environmental factor on the growth rate of a crop plant.
 - (c) The butterfat content of milk.
 - (d) The activity of the liver enzyme catalase.

[Marking_Scheme2008](#)

2007

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The effect of structure formation on total pore space in soils.
 - (b) The determination of the percentage germination of a sample of seed.
 - (c) The botanical composition of an old permanent pasture.
 - (d) The determination of the digestibility of rolled grain as compared to whole grain.

[Marking_Scheme2007](#)

2006

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The presence of a **named** mineral nutrient in a soil sample.
 - (b) The extraction of pigments from a sample of grass.
 - (c) The presence of protein in a sample of peas.
 - (d) The production of heat during the germination of seeds.

[Marking_Scheme2006](#)

2005

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The measurement of the total pore space within a soil.
 - (b) The bacterial quality of a sample of milk.
 - (c) The action of a named animal enzyme.
 - (d) The growth reaction of a plant shoot to an external stimulus.

[Marking_Scheme2005](#)

2004

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The presence of a **named** major element in a soil sample.
 - (b) An estimation of the protein content in a sample of silage.
 - (c) An estimation of the yield per hectare of a root crop prior to harvesting.
 - (d) The percentage of water and solids in a sample of milk.

[Marking_Scheme2004](#)

2003

4. Describe a laboratory or field method to show any **two** of the following:
- (a) The presence of micro-organisms in an animal foodstuff.
 - (b) How the activities of earthworms have an important role in the soil.
 - (c) The productivity of an area of grassland.
 - (d) The action of a named animal enzyme.

[Marking_Scheme2003](#)

2002

4. Describe a **laboratory method** used to show **any two** of the following:
- (a) The estimation of sugars in grass for silage.
 - (b) The presence of a named mineral nutrient in a soil sample.
 - (c) Transport of water in plants (Transpiration).
 - (d) The percentage of a named food constituent in a sample of a named root crop.

[Marking_Scheme2002](#)

2001

4. Describe a laboratory or field method to determine **any two** of the following:
- (a) Cation exchange in a sample of soil.
 - (b) The importance of **two named** elements for normal plant growth.
 - (c) The diversity of plant life found in an old meadow.
 - (d) The energy value of a named foodstuff.

[Marking_Scheme2001](#)

2000

4. Describe a laboratory method used to determine any **two** of the following:

- (i) the role of earthworms in a soil,
- (ii) the role of amylase in the digestion of starch,
- (iii) the effect of an additive on ensiled grass,
- (iv) the leaching of mineral nutrients in a soil.

(48 marks)

1999

4. Describe a laboratory method used to determine any **two** of the following:

- (i) The presence of bacteria in milk.
- (ii) Capillarity in a plant stem.
- (iii) The action of a named animal enzyme.
- (iv) The sugar content of beet in varying weather conditions.

(48 marks)

2010 Marking Scheme

4. (a) SOIL TEXTURE:

dry soil/ oven/ weigh/ crush/ how crush/ sieves/ re-weigh/ calculate
OR

soil sample/ in a suitable vessel/ add water to cover soil/ stopper/
shake/ allow to settle/ measure sand sily and clay/ textural triangle/
conclusion

OR

wet soil/ rub between fingers and thumb/ note grittiness or
smoothness/ roll into a ball/ make threads of it/ bend into rings/
result/ conclusion

6 (4m)

(b) EARTHWORMS:

mark out areas eg quadrat m sq/ mow grass/ add diluted detergent
(or alternative)/ to areas/ slowly with a watering-can/ wait for a period/
observe result/ count no. of worms/ get an average/ multiply by no of
sq m (hectares) in field

6 (4m)

(c) TRANSPIRATION RATE:

leafy shoot/ cut at an angle/ potometer (burette potometer)/ water/
seal with Vaseline/ place in light/ air bubble/ measure bubble position/
leave/ time/ repeat/ average/ calculate/ control

6 (4m)

(d) BARLEY DIGESTIBILITY:

whole barley/ rolled barley/ 2 cows (or same cow on successive
occasions)/ keep cows indoors/ feed same amount of barley to
each cow eg 0.5kg/ keep cows in same place for 12 hours/ collect
dung/ and examine for undigested grains

OR

whole grain in one test tube/ rolled grain in the other/ amylase/
add water/ water bath/ leave for a time/ test for starch or sugar/
name reagent/ describe result/ compare.

6 (4m)

2009 Marking Scheme

4. (a) Seed tray or seed module/ growing medium/ add 100 seeds or stated number/
keep warm/ keep damp/ leave (for 2 weeks)/ count no. that sprouted/ repeat a
no. of times/ get average/ calculation

6 (4m)

(b) Get a known mass of water/ take temperature of water/ in a suitable container/
weigh food sample/ ignite food sample/ water is heated/ wait until food is
completely burned/ stir water/ take highest temp reached/ calorific value of sample =
mass of H₂O x 4180 x rise in temperature/ correct unit mentioned

6 (4m)

- (c) Measure out two suitable areas of grassland/ with quadrats/ area 1 treated with selective herbicide/ when conditions are favourable/ April – Oct when dry spell is forecast/ 2-4D or CMPP or MCPA or MCPB or appropriate selective commercial brand/ area 2 is control/ untreated or lower regime of chemical/ leave (for week)/ broadleaf weeds are killed/ grass spp. are unaffected 6 (4m)
- (d) Cut off roots/ wash off soil/ dip in mild disinfectant/ (prepare bench area by the sterile method/ squash nodules/ how squash/ onto filter paper/ streak onto agar plate/ with inoculating loop/ control/ incubate (for one week)/ colonies/ are white spots 6 (4m)

2008 Marking Scheme

4. (a) Chop/ dry grass/ place in plastic bag/ roll up to remove air/ place in freezer/ remove when frozen/ squeeze drop of cell sap/ place in refractometer/ read off percentage sugar on scale/ repeat or average 6 (4m)
- (b) named factor (e.g. named mineral/ water/ light/ temperature/ tropisms etc.)
control
Any **four** other valid points 6 (4m)
- (c) Sample of milk from beginning of milking/ sample of milk from end of milking/ (sample of milk: one point) bring sample to approx 20°C/ add (concentrated) sulphuric acid/ to butyrometer/ add milk gently down side of butyrometer/ add (amyl) alcohol/ stopper/ invert/ transfer to centrifuge/ centrifuge/ remove samples/ place in water bath heated to 65°C/ leave/ read percentage fat from graduations/ result 3-5% fat
- (d) sample of fresh liver/ cut into pieces/ grind with mortar and pestle/ and sand/ place hydrogen peroxide in tube/ constant pH/ constant temperature/ add washing-up liquid/ add liver/ note foam/ measure rate (stop watch, height of foam)/ control 6 (4m)

2007 Marking Scheme

4. (a) *two different soil samples/ sieve soil/ crush one sample/ add equal volume of samples/ to two graduated cylinders/ pour water into cylinder/ record volume/ shake/ record volumes/ calculation
OR
* two different soils/ one compacted/ take can of known volume/ place upturned can in ground/ remove sample/ add water until full/ record volume of water added/ compare results 6 (4m)
- (b) 100 seeds/ moisten/ place in suitable container/ on suitable substrate/ at suitable temperature/ air or oxygen available/ leave for a period/ observe germination/ count/ number equals % or calculate/ repeat/ average 6 (4m)

(c) quadrat/ transect/ random throw or numbers/ repeat/ identify species or name species/
record/ percentage cover or frequency/ display or present result 6 (4m)

(d) two cows/ housed indoors/ clean area/ feed same weight of grain/ one fed whole barley/
second fed rolled barley/
- leave loose for 1 hour/ confine for 12 hours/ collect all dung separately/ water and sieve/
examine for presence of grains/ compare OR weigh cows at start/ feed over long period/
weigh at end/ compare
OR
crushed grain sample/ whole grain sample/ add to water/ water bath/ amylase/ leave for
a time/ test for sugar or starch/ name of reagent/ describe positive result/
compare 6 (4m)

2006 Marking Scheme

4. (a) named mineral 4m
how sample obtained/ named apparatus/ add distilled water to soil sample/ add
reagent/ shake and filter/ dry in oven/ add dilute nitric acid to crystals/ add ammonium
molybdate/ leave/ yellow indicates phosphate/ add diphenylamine/ blue indicates
nitrate/ describe control/ use colour chart/ to indicate mineral any five related points 5 (4m)
- (b) named apparatus/ grind grass leaves/ boil grass leaves/ in alcohol/ place drop of extract
on chromatography (filter) paper/ concentrate drop/ solvent in covered gas jar/ place end
of paper in solvent (acetone + petroleum ether)/ pigments separated/ name of one
pigment 6 (4m)
- (c) biuret test/ crush peas/ in distilled water/ filter/ sample in container/ add biuret solution/
add dilute NaOH/ shake/ add copper sulfate solution/ shake/ violet colour is positive/
blue is negative 6 (4m)
- (d) named seeds/ soaked/ control/ disinfectant/ place in insulated container/ cover/ thermometer/
record temperature/ leave/ observe temperature change 6 (4m)

2005 Marking Scheme

4. (a) empty can/ measure volume/ bore small hole in bottom/ insert in ground/ remove soil sample/
add water to graduated cylinder/ finger on base of tin/ pour water into soil sample until full/
measure amount of water used/ calculate percentage of volume of can/ this is percentage
of air OR alternative experiment. 6 (4m)
- (b) Resazurin or Methylene Blue test/ sterile tube/ milk in tube/ add solution and stopper/
incubate/ examine colour/ blue is good quality/ pink or white poor quality
OR
sterile/ agar plates/ inoculating loop/ smear with milk/ control/ seal/ incubate/ 24-48 hours/
observe bacteria 6 (4m)

- (c) **named enzyme (compulsory)** 4m
 named substrate/ experimental procedure (any valid points)/ named product/
 test for product 5 (4m)
- (d) potted plant or seedlings/ named stimulus (e.g. gravity or light)/ control/ clinostat/
 leave for a period to grow/ inspect regularly/ results 6 (4m)

2004 Marking Scheme

4. (a) **named element** 4m
 field method for sampling/ put soil sample in container/ add distilled H₂O/ stopper
 and shake/ filter contents/ add drops of correct named reagent*/ note result** 5 (4m)
 nitrogen: * diphenylamine/ ** blue precipitate
 phosphorus: * ammonium molybdate/ ** yellow precipitate
 sulfate: * barium chloride/ ** white cloudiness
 chloride: * silver nitrate/ ** white precipitate
 * and ** compulsory
 OR
 field method for sampling/ use soil test kit/ distilled H₂O/ make up solution according to
 directions/ add to soil/ leave for x weeks/ description of result 5 (4m)
- (b) weigh sample/ separate leaf from stem/ weigh each leaf/ leaf to stem ratio/ ratio
 proportional to protein
 OR
 Kjeldahl method to detect N/ protein is 16%/ % protein = / % Nx 100/16 4 (6m)
- (c) quadrat/ 1m² (or other known area)/ name of crop/ remove crop/ remove tops/ weigh/
 record/ repeat/ average weight per area/ yield per drill/ number of drills/ area of field/
 calculate per hectare/ correct yield 6 (4m)
- (d) weigh container/ weigh sample and container/ weight of sample/ heat 105°C or boil/
 weigh again/ calculate difference/ weight lost is water content/ estimate percentage of water/
 estimate percentage of solids 6 (4m)

2003 Marking Scheme

4. (a) sample of foodstuff/ sterile agar plates (allow two points for description of making sterile
 agar plates)/ control (unopened plate)/ inoculate plate with foodstuff/ incubate/ upside down/
 time/ furry growth is fungus/ dome shaped colonies are bacteria/ control is clear/
 micro-organisms from foodstuff 6 (4m)
- (b) wormery/ different types of material/ soil/ gravel or sand/ chalk/ leaves/ in layers in wormery/
 add worms/ cover/ leave/ observe layers mixed up/ worms bring down leaves/ mix soil
 layers/ control 6 (4m)

- (c) measure area of grassland/ enclose area/ mow the grass from the top/ find mass of the grass removed/ record/ repeat this over defined time/ total mass of grass is a measure of productivity
 OR
 measure area of grassland/ enclose (fence) area/ allow cows graze on grass/ milk cows regularly/ measure the amount of milk/ record/ total amount of milk is a measure of productivity
 OR
 measure area of grassland/ enclose (fence) area/ weigh a number of cattle/ record/ allow cattle to graze on grass/ reweigh cattle after a fixed period/ weight increase is a measure of productivity 6 (4m)
- (d) named enzyme/ named (matching) substrate/ suitable medium/ suitable apparatus/ mix enzyme and substrate/ suitable temperature/ observe change or test for product/ name product formed 6 (4m)

2002 Marking Scheme

4. (a) dry sample of grass/ place sample in plastic bag/ roll bag to remove air/ place in a freezer until frozen/ remove from freezer/ cells have burst releasing sap/ squeeze out a drop and place in a refractometer/ obtain reading and two further readings on two other drops
 Result: Calculate the mean reading/ estimate the % soluble carbohydrate
 Conclusion: Knowing the carbohydrate concentration will allow you estimate the amount of additive required
- | | |
|---------------------------|--------|
| <u>valid points</u> | 5 (4m) |
| <u>result/ conclusion</u> | 4m |
- (b) soil samples in flasks/ add 50ml of water/ stopper and shake for 3-4 minutes/ filter the flask contents into a beaker/ add a few drops of a named reagent
- Nitrates – diphenylamine
 - Phosphates – Ammonium molybdate
 - Sulfates – Barium chloride
 - Chlorides – Silver nitrate
- Result: Observe the colour change
- Nitrates – Blue colour
 - Phosphates – Yellow ppt
 - Sulfates – White cloudiness
 - Chlorides – White ppt
- Conclusion: The soil contains
- | | |
|---------------------------|--------|
| <u>valid points</u> | 5 (4m) |
| <u>result/ conclusion</u> | 4m |

- (c) take a cutting/ put in water for a number of hours/ photometer/ fill under water/ cut the end of cutting under water/ to prevent air in the xylem vessels/ place in photometer/ seal with Vaseline/ remove from water keeping the capillary tube end immersed in a beaker of water/ lift the capillary end gently and allow an air bubble to enter/ record the position of bubble/ place the photometer on a window sill for a number of hours/ record the position of bubble

Result: The bubble has moved closer to the plant

Conclusion: Water lost through the leaves was replaced by the water in the photometer.

Water was lost due to transpiration	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

OR

Potted plant/ well watered/ soil covered/ bell jar or clear plastic bag over plant/ leave in sunlight for 5-6 hours

Result: condensation on inside of jar/ plastic bag/ cobalt chloride paper proves it is water

Conclusion: Transpiration occurs	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

OR

Stick of celery/ dyed water/ celery in water and leave for X time/ take cross section

Result: tubes/ xylem vessels coloured

Conclusion: Water movement by transpiration	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

- (d) dry sample of sugar beet/ place sample in plastic bag/ roll bag to remove air/ place in a freezer until frozen/ remove from freezer/ cells have burst releasing sap/ squeeze out a drop and place in a refractometer/ obtain reading and further two readings on two other drops
Results: Calculate the mean reading/ estimate the % soluble carbohydrate

Conclusion: sugar beet contains x % sugar	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

2001 Marking Scheme

4. (a) soil sample/ filter paper/ funnel/ slowly drop potassium chloride (1%)/ test first drops of leachate for element e.g. Calcium/ 10 drops of leachate + 1 drop ammonium oxalate/ shake
Result: A white ppt.

Conclusion: soil is now potassium dominant/ the calcium in the soil has been replaced by potassium	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

- (b) 3 flasks/ sterilise/ 3 plant seedlings of equal size/ nutrient tablets – one with all (control) two minus one element each/ aeration tube/ tinfoil cover/ measure and take plant description at the start/ run for weeks/ measure at weekly intervals/ top up nutrient medium during expt.

Result: control grows well/ others either stunted, yellowing leaves (chlorosis) etc.

Conclusion: Relate elements X and Y to the deficiencies observed (e.g. Nitrogen = stunted growth, due to a lack of protein, Magnesium = chlorosis, due to the inability to make chlorophyll)

	<u>valid points</u>	5 (4m)
	<u>result/ conclusion</u>	4m

- (c) Use of quadrat (random or non random)/ transect/ collection of plants/ identification keys/ list plants found/ place in families
 Results: illustrate some results found (table or graph or words) from different areas within the meadow
 Conclusions: Does the meadow show diversity or not
- | | | |
|--|---------------------------|--------|
| | <u>valid points</u> | 5 (4m) |
| | <u>result/ conclusion</u> | 4m |
- (d) simple calorimeter/ vol. of food in crucible/ 100cm³ in beaker + note temp/ heat food till burns/ place burning food under water/ leave there till food is completely burned/ note final water temp/
 Results: The increase in temp of water
 Conclusions: increase in water temp. can be related to the burning foodstuff (per unit weight)
- | | | |
|--|---------------------------|--------|
| | <u>valid points</u> | 5 (4m) |
| | <u>result/ conclusion</u> | 4m |