



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Leaving Certificate 2016**

**Marking Scheme**

**Agricultural Science**

**Ordinary Level**

### **Note to teachers and students on the use of published marking schemes**

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

### **Future Marking Schemes**

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.

## **Introduction**

### **General points**

- The marking scheme is a guide to awarding marks.
- Examiners must conform to this scheme, and may not allow marks for answers outside the scheme.
- In many cases only key phrases are given in the marking scheme. These points contain the information and ideas that must appear in a candidate's answer in order to merit the assigned marks.
- The descriptions, methods and definitions given in the marking scheme are not exhaustive and alternative valid answers are acceptable.
- If an examiner determines that a candidate has presented a valid answer, and where there is no provision in the scheme for accepting said answer, then the examiner must first consult with his/her advising examiner before awarding marks. In general, if an examiner is in any doubt whether a particular answer is correct he/ she should consult their advising examiner before awarding marks.
- The detail required in any answer is determined by the context, the phrasing of the question and by the number of marks assigned to the answer in the examination paper. This may vary from year to year.
- Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable for a particular point. A word or phrase given in brackets is an acceptable alternative to the preceding word or phrase. Note, however, that words, expressions or phrases must be correctly used in context and not contradicted and where there is evidence of incorrect use or contradiction, the marks may not be awarded.
- In general, names and symbols/ formulae of elements/ compounds are equally acceptable. However in some cases where the name is asked for, the symbol/ formula may be accepted as an alternative. This is clarified within the scheme.

### **Cancelled answers**

- If the only answer offered is cancelled ignore the cancelling and mark as usual.
- If an answer is cancelled and a second version of the answer is given, you should accept the cancellation and award marks, where merited, for the un-cancelled version only.
- If two un-cancelled versions of an answer are given to the same question or part of a question, mark both and accept the answer that yields the greater number of marks. You may not, however, combine points from both versions to arrive at a manufactured total.

## Surplus answers

- In Section One, a surplus wrong answer cancels the marks awarded for a correct answer.

e.g. Question: Choose two dairy breeds from the following list of cattle breeds:

List: Charolais Friesian Simmental Jersey Hereford

Marking scheme: Friesian/ Jersey/ Simmental **Any two    2 × 1 marks**

Answer: Friesian, Jersey and Hereford – the surplus answer (Hereford) is incorrect, therefore the candidate scores  $2 - 1 = 1$  mark.

## Conventions

- The mark awarded for an answer appears in the marking scheme next to the answer on the right hand side.
- Where there are several parts in the answer to a question, the mark awarded for each part appears as e.g. 3 × 4 marks. This means there are three parts to the answer, each part allocated 4 marks.
- Award unit marks separately, e.g. if an answer merits 3(3), write:  
3  
3  
3  
in the first column in the right-hand margin.
- The answers to subsections of a question may not necessarily be tied to a specific mark e.g. there may be three parts to a question - (i), (ii), (iii) and a total of 12 marks are allocated to the question. The marking scheme might be as follows: 6 marks + 3 marks + 3 marks. This means that any first correct answer is awarded 6 marks and each subsequent correct answer is awarded 3 marks.
- Square brackets/ *italics* are used where the examiner's attention is being drawn to an instruction relating to the answer or to some qualification of the answer.
- The total mark for each question should be written beside the question number, and circled.
- The cumulative total should be written in the bottom right-hand corner of each page on which a question total appears.
- All blank pages should be marked to indicate they have been inspected.

## **Section 1. Best six from Q.1. to Q.7.**

### **Question 1.**

- (a) (i) Two sedimentary rocks: 1. Sandstone 2. Limestone **2 × 2m**
- (ii) Two metamorphic rocks: 1. Marble 2. Quartzite **2 × 2m**
- (b) (i) Flask A. **2m**
- (ii) Microorganisms or living organisms in A/ release CO<sub>2</sub> / during respiration **Any two 4m + 2m**
- (iii) Heating the soil strongly or burning the soil or disinfectant **2m**
- (iv) To compare (with flask A) or comparison described **2m**

### **Question 2. (10 × 2m)**

(a)	F
(b)	T
(c)	F
(d)	T
(e)	T
(f)	F
(g)	F
(h)	F
(i)	T
(j)	T

### **Question 3. (5 × 4m)**

- (a) High milk yields or good quality milk or high % protein or highly efficient at converting grass to milk or produce good replacement heifers
- (b) To determine soil pH or to determine nutrient status of soil or to test soil for nutrient deficiency or to determine amount of fertiliser(s) to apply to crop or to determine fertility of soil or response to fertiliser
- (c) Fast growing or high yielding or additional winter feed or less risk of fodder shortage or fewer meals required or reduces cost of winter feed or early bite for cows or prevents leaching
- (d) Avoids pollution or less risk of run-off or prevents soil compaction or prevents damage to soil structure or legislation or optimises use by crop or gives time for soil (or crop) to absorb it or avoids contamination (of silage) or weather too wet
- (e) Pest control or disease control or weed control or more balanced uptake of nutrients or improves soil structure or improves soil fertility or prevents plough pan or adds organic matter or improves yield or prevents nutrient depletion

**Question 4. (5 × (2m + 2m))**

Equipment	Letter	Main use
Soil sieves	D	To determine soil texture or to separate soil (particles) or to determine % of soil particles (or named soil particle(s) )
Potometer	E	To measure (the rate of) transpiration or to measure (the rate of) water uptake
Inoculating loop	A	To transfer soil (or milk or microorganisms) to agar plate or to streak the agar plate
Refractometer	C	To determine % sucrose content in sugar beet or grass
Pooter	B	To collect insects (or small animals) or to suck up insects

**Question 5. (4 × 3m) + (4 × 2m)**

- (a)
- (i) A = Petal  
B = Anther [*accept 'stamen'*]  
C = Carpel [*accept 'ovary'*]
  - (ii) To protect the (flower) bud or young flower
- (b)
- (i) X = stolon or runner or (horizontal) stem
  - (ii) Asexual (reproduction) or vegetative (reproduction)
  - (iii) A clone
  - (iv) Sexual (reproduction)

**Question 6. (6 x 3m) + 2m**

- (a) (i) A = (Liver)fluke  
B = Cranefly or daddy long-legs  
C = (Sheep) tick
- (b) (i) (Endo) parasite (of sheep and-or cattle) or causes weight loss (or lack of thrive)  
or causes diarrhoea or causes anaemia or causes lump under lower jaw or damages liver  
or reduces milk yield or causes death (in acute cases) or causes harm to animal
- (ii) Larva (or leatherjacket) attacks crop(s) or larva is pest of crops or larva attacks (or damages) crops  
or adult lays eggs which hatch into leatherjacket or larva attacks roots and-or stems of plants
- (iii) Host of *Babesia* or transfers *Babesia* to cattle or sucks blood or *Babesia* multiply inside sheep tick or irritates skin or bites into skin or is a parasite of sheep or harms animal
- (iv) (Liver)fluke or A

**Question 7. (4 × 3m) + (4 × 2m)**

(a) (i) and (ii)

Animal feed or meal or concentrate/ malting or alcohol/ (straw for) bedding/ straw for feeding/  
human food **Any two**

(b) (i) and (ii)

Grain or seed becomes hard/ seed becomes dry/ ear or seed-head and-or straw turns golden or yellow  
colour/ seed-head bends over (and lies parallel to stem)/ flag leaf withers

**Any two**

(c)

- (i) Prevents damage to crop when driving through it or allows farmer to apply fertilisers or herbicides or pesticides or weedkillers or allows farmer to spray crop or allows more efficient use of fertiliser
- (ii) To sow the seed and fertiliser together or allows placement of fertiliser or more efficient use of fertiliser or reduces labour costs or reduces fuel costs/ gets job done faster
- (iii) Levels the soil or ensures even seed-bed or breaks up (lumps of) soil or buries seed or prevents seed being blown away or ensures better seed-soil contact or brings up moisture or buries stones or compacts the soil
- (iv) Grain is drier or reduces damage to crop or reduces soil compaction or reduces moisture content at harvest or easier to harvest or prevents “clogging” of machine or less spoilage in storage or less acid required prior to storage or reduces need for drying prior to storage or straw will be drier or easier to bale straw

## Section Two. Best three from Q.8 to Q.13.

### Question 8.

(a)

- (i) Grass: Perennial ryegrass (or PRG) or Italian ryegrass (or IRG)  
[Accept 'ryegrass']

3m

Other plant species: e.g. Clover

3m

- (ii) [Any one reason for the use of either of the two grasses]

3m

*Perennial ryegrass:* High productivity or high yield or highly digestible or high % DMD  
or palatable or "sweet" or persistent or high tillering capacity or long growing season or recovers well after grazing or aggressive or good ground cover or dominates pasture or reduces weeds or supports high stocking rates or promotes higher weight gains or higher milk yields

**Or**

*Italian ryegrass:* High productivity or high yield or highly digestible or high % DMD  
or palatable or "sweet" or long growing season or recovers well after grazing or supports high stocking rates or early bite for cows or promotes higher weight gains or higher milk yields

[Any one reason for the use of the other species]

3m

e.g. *Clover:* Nitrogen fixation or improves fertility of soil or rich in protein or rich in minerals or rich in iron or palatable or ground cover or weed control or provides grazing during mid-summer ("slump" in grass growth)

- (iii) Named method

2m

[Any four points from one of the following methods]

4 × 3m

*Direct sowing:*

Plough/ harrow or cultivate soil/ roll soil before sowing/ apply fertiliser/by broadcasting/ sow grass seed / apply fertiliser and seed together/ using combine drill/ roll soil after sowing (to bury seeds)/ Autumn sown or September/ Spring sown or April-May

**Or**

*Undersowing:*

Common in tillage farming/ nurse or companion crop/ companion crop named e.g. barley/ short- strawed varieties/ Spring time or March – April / plough/ harrow or cultivate soil/ roll soil before sowing/ apply fertiliser/ sow nurse crop/ sow grass seed/ roll soil after sowing (to bury seeds)/ harvest nurse crop in August-September or arable silage

**Or**

*Direct drilling (or direct seeding):*

Land not ploughed/ old grassland grazed bare/ herbicide applied/ to kill weeds and remaining grass/ slits created/ grass seed and fertiliser applied into slits/ slug pellets applied into slits/ new grass seedlings emerge/ suitable method of re-seeding in shallow soils

**Or**

*Stitching-in:*

Land not ploughed/ old grassland grazed bare/ no herbicide applied/ old grassland remains / slits created/ grass seed and fertiliser applied into slits/ slug pellets applied into slits/ new grass seedlings emerge/ suitable method of re-seeding in shallow or poached soils

(b) (i) Easier to make in small fields/ no need for pit or lower capital costs/ easier to transport/ easier to buy or sell/ less effluent/ lower pollution risk/ less spoilage or can be kept longer / better quality/ lower dry matter losses in storage/ easy to store / less weather dependent

**2 × 3m**

(ii) More expensive to make/ not suitable for very wet silage/ more labour involved at feeding time/ more time consuming at feeding time/ bales can be damaged/ disposal of plastic/ heavy to handle/ special equipment needed to lift bales

**2 × 3m**

(c) [Any four points each from two of the following tests]

**2[(3 × 3m) + 2m]**

Examine the colour of the silage/ if yellow colour/ good quality silage or lactic acid preservation/ if brown or dark colour/ poor quality silage or butyric acid production/ repeat (to get representative sample)

**Or**

Examine the smell of the silage/ if sharp or vinegar smell/ good quality silage/ if rancid or “rotten” smell/ poor quality silage/ repeat (to get representative sample)

**Or**

Squeeze the silage between hands/ if juice runs freely/ low % dry matter content (DM) or 15% D.M. or low quality silage/ if juice drips out/ average D.M. content or 20% D.M. or average quality silage / if no (or barely any) juice runs out / high D.M. content or 25% D.M. or good quality silage/ repeat

**Or**

Squeeze the silage between hands/ collect juice/ test with universal indicator/ determine pH using colour chart/ if pH < 5/ good quality silage/ if pH > 5/ poor quality silage/ repeat

### **Question 9.**

- (a)
- (i) A = Trachea or windpipe  
B = Bronchus  
C = Diaphragm
- [Accept ring(s) of cartilage once for either A or B] **3 × 3m**
- (ii) Gaseous exchange or described **3m**
- (iii) Good ventilation/ no draughts/ dry housing/ adequate space per animal or avoid over-crowding/ colostrum/ vaccination/ adequate cubic capacity or air space or high roof/ reduce stress/ isolation or quarantine or biosecurity **Any two 6m + 3m**
- (iv) Adult (female) worm/ lays eggs / inside lungs/ eggs coughed up into mouth/ eggs swallowed/ enter intestine/ exit animal in faeces/ eggs on pasture/ hatch/ larvae / larvae eaten by animal/ enter stomach/ enter bloodstream/ carried to lungs/ larvae mature **Any three 3 × 4m**
- (v) Vaccination or dosing or leader-follower system or isolate or quarantine (infected animal) **3m**
- (b)
- (i) Excretion/ getting rid of wastes/ osmoregulation/ control of water balance or salt balance in body or filters blood **3m**
- (ii) X = Ureter  
Y = Bladder  
Z = Urethra **3 × 3m**
- (iii) Urine or salt or urea or water **3m**
- (c) Rough grazing or long grass/ (sheep) tick/ sucks blood/ from infected cow/ blood contains *Babesia*/ *Babesia* form gametes/ form zygotes/ spores formed/ asexual reproduction/ tick bites another (healthy) cow/ spores enter healthy cow/ enter red blood cells/ lack of preventive measure/ vet not called/ infected animal not isolated **Any three 3 × 3m**

**Question 10.**

- (a)
- (i) Damages leaves or damage described or less photosynthesis or tubers rot **3m**
- (ii) Black or brown spots on leaves and-or stems/ white mouldy growth on underside of leaves/ tubers go black/ tubers rot  **$2 \times 3m$**
- (iii) Certified seed/ resistant varieties/ rotation/ avoid groundkeepers/ isolate potato dumps or bury last years potatoes/ earthing up/ heed blight warnings/ remove infected plant(s) immediately/ spray/ fungicide/ repeat spray/ dessicant  **$2 \times 3m$**
- (b)
- (i) (Medium) loam or good texture/ deep soil/ fertile/ good drainage/ good aeration/ good structure/ free from stones/ pH = 5.0 – 6.5/ brown earth or grey-brown podzolic **Any two 6m + 3m**
- (ii) Potato planter/ seed planted in ridges or drills/ planted 10 – 15cm below soil/ planted 25-35 apart in the ridge/ in bag or suitable container/ dig with spade **Any one 6m**
- (iii) Spray/ herbicide/ earthing up/ mechanical or explained e.g. hoeing/ hand pulling/ burning/ shading action/ rotation **Any two  $2 \times 3m$**
- (iv) Elevator digger/ collected by hand/ complete harvester/ haulms or tops cut at harvesting/ June -July (earlies)/ August – December (maincrop)/ yield of 7-10 tonnes/ha (earlies) / yield of 30 – 40 tonnes/ha (maincrop)/ avoid tuber damage/ avoid wet or frosty harvesting **Any two  $2 \times 3m$**
- (c) Wash (soil from) potatoes/ dry potatoes/ weigh empty beaker or suitable container/ cut potatoes/ equally sized cubes/ place in beaker/ re-weigh/ find mass of potatoes by subtraction/ place in oven/ 100° C / 15 minutes/ re-weigh/ constant mass/ calculate loss in mass/ this equals mass of water/ calculate % water content using  $(\text{mass of water} \div \text{mass of fresh potatoes}) \times 100/1$   
[Award maximum of 15m if no attempt at calculation]  
[Some, or all, of marks in method may be obtained from labelled diagram] **Any six  $6 \times 3m$**

**Question 11.**

(a)

	<i>Sandy soil</i>		<i>Clay soil</i>
(i) <i>Drainage</i>	Well drained	<b>or</b>	Poorly drained
(ii) <i>Fertility</i>	Low fertility	<b>or</b>	High fertility
(iii) <i>Organic matter content</i>	Low	<b>or</b>	High
(iv) <i>Soil temperature</i>	High	<b>or</b>	Low

**4 × 4m**

(b)

(i) Add organic matter or named example or increase soil fertility / drain soil/ add lime/ aerate soil

**2 × 3m**

(ii) Create channels or holes/ improve drainage/ improve aeration/ mix soil/ create humus/ decompose organic matter/ improve soil texture/ improve soil structure/ improve soil fertility

**Any two 2 × 3m**

(iii) Annelida

**3m**

(iv) Diagram

**(5m, 3m, 0m)**

[For 5 marks: cylindrical shape **and** segmented body; if 1 missing, award 3m; if 2 missing, award 0m]

Labels: Mouth/ segment(s)/ anus/ clitellum or saddle/ setae or bristles/ cylindrical (shape)

**3 × 2m**

(c)

(i) Green colour or chlorophyll formation or protein formation or nucleic acid formation or increases crop growth or increases yield or leafy growth

**3m**

(ii) Urea/ C.A.N./ ammonium sulphate/ 10:10:20/ 5:5:10/ 7:6:17/ 18:6:12

**2 × 3m**

(iii) Pollution/ eutrophication/ algal bloom/ fish kills/ loss of nitrogen from crop/ reduced crop yield/ reduced crop growth or stunted growth/ chlorosis or deficiency symptom described

**2 × 3m**

(iv) Nitrogen fixation or explained

**3m**

**Question 12.**

- (a)
- (i) Nucleus **4m**
- (ii) Carry genes or ‘in heredity’ **4m**
- (iii) 27 **4m**
- (b)
- (i) Gametes  $(P) \times (p)$  **2 × 4m**
- (ii) Genotype of calf  $(Pp)$  **4m**
- (iii) Phenotype of calf Polled (or hornless) **4m**
- (c)
- (i) Genotypes of parents  $(Pp) \times (Pp)$  **2 × 2m**
- (ii) Possible gametes  $(P) (p) \times (P) (p)$  **4 × 2m**
- (iii) Possible gametes of calves  $(PP) (Pp) (pp)$  **3 × 2m**
- (iv) Possible phenotypes of calves Polled      Horned **2 × 2m**
- (d)
- (i) Crossing two different breeds of the same species **4m**
- (ii) Ewes are better mothers/ ewes are more prolific/ lambs have faster growth rates/ ewes have more milk/ increased hardiness/ hybrid vigour **Any two 4m + 2m**

**Question 13. Answer any two parts (30m + 30m)**

- (a)
- (i) Suffolk/ Texel/ Border Leicester/ Bluefaced Leicester/ Galway **2 × 3m**
- (ii) *Suffolk*: Terminal sire/ excellent conformation or one conformation point described/ short/ good carcase quality/ fast growth rates/ shortwool/ dark wool/ black head/ polled/ early lamb production or Easter market **2 × 3m**
- Or**
- Texel*: Terminal sire/ excellent conformation/ good carcase quality/ shortwool/ white wool/ white face/ mid -season lamb production/ wide face/ no wool on head **2 × 3m**
- Or**
- Border Leicester*: Prolific breed/ large breed/ long-wool/ white wool/ polled/ upright ears **2 × 3m**
- Or**
- Bluefaced Leicester*: Prolific breed/ large breed/ long-wool/ white wool/ polled/ upright ears/ roman nose/ blue skin/ upright ears **2 × 3m**
- Or**
- Galway*: Large breed/ white wool/ polled/ long-wool/ “bob” of wool on forehead/ good growth rates/ not prolific **2 × 3m**
- (iii) Clear mucus/ navel dip/ colostrum/ vaccinate/ tail docking/ lambing pen/ make sure ewe suckles lamb/ mark lamb/ tag lamb/ infra-red lamp/ castration/ dosing/ hardening off/ hygiene/ one feeding point/ one housing point **Any three 3 × 4m**
- (iv) *Flushing*: Process of moving ewes from a low plane of nutrition to a high plane of nutrition prior to mating or moving ewes to better grazing before mating **3m**  
[Accept reason(s) for flushing e.g. increases fertility]
- Steaming up*: Practice of feeding (increasing amount of) meals to ewes in late pregnancy  
[Accept reason(s) for steaming up e.g. prevents twin lamb disease] **3m**
- (b) (i) Large white/ Landrace/ Duroc/ Saddleback/ Tamworth **2 × 3m**
- (ii) *Dry sow house*: Kept loose/ vaccinate/ provide clean water/ fed 2-3 kg meals per day/ hygiene/ mated 7-8 days after weaning/ maintain temp. at 20° C **Any two 2 × 3m**
- Farrowing house*: Washed/ de-wormed or dosed/ treated for lice/ dis-infected/vaccinated/ good hygiene/ placed in farrowing crate/ provide temperature of 20°C/ provide clean water/ fed 5-6 kg meals per day **Any two 2 × 3m**
- (iii) *Cause of anaemia*: lack of iron (in the diet) **3m**
- Prevention*: Iron injection (in 1<sup>st</sup> week of life) **3m**
- (iv) Good conformation/ Good feet and legs/ 12 well-formed teats/ healthy/ reached puberty/ docile correct weight or correct body condition score/ have come from mothers that are good milkers/ come from mothers that are prolific **Any two 2 × 3m**

(c)

- (i) Good hygiene/ adequate supervision/ isolate cow at calving or calving box/ steaming up of cow/ reduce level of meal feeding in final week of pregnancy/ clear mucus/ navel dip/ colostrum/ proper equipment/ call vet (if necessary)/ good housing/ choice of bull (ease of calving)/ correct feeding technique (for calves)

**Any three**  $3 \times 3\text{m}$

- (ii) Rich in antibodies/ prevents diseases/ rich in nutrients/ laxative effect/ warms the calf/ high in energy  
**2 × 3m**

- (iii) Clean holding area/ milker hygiene/ parlour hygiene/ wash or wipe udder/ strip cup/ teat dip/ filter/ plate cooler/ wash equipment regularly/ clean bulk tank/ cool milk to 4°C or less in bulk tank/ fly screens/ rubber mats or lime/ disease control  
**2 × 3m**

- (iv) Old age/ grading up/ lameness/ disease/ low milk yields/ low milk quality/ infertility/ difficult to get back in calf or extended calving interval/ calving difficulties/ high somatic cell count/ slow milkers/ diseased udder  
**3 × 3m**

(d)

- (i) To produce glucose or sugar [Accept 'starch']  
**3m**

- (ii) Chlorophyll  
**3m**

- (iii) **Method A:**

Diagram:  
**(3m, 0m)**

[For 3 marks diagram must show (potted) plant **and** plastic bag **and** dish (of soda lime)]

Labels: plant/ plastic bag/ rubber band/ dish/ soda lime  
**3 × 1m**

*Method*

Plant/ label A and B/ place in darkness/ 48 hours/ removes starch/ dish of soda lime in A/ soda lime absorbs CO<sub>2</sub>/ control/ water plants/ cover both plants with clear plastic/ light source/ ≥ 2hours/ remove leaf from each plant/ boil leaf/ kills leaf/ place each leaf in alcohol for 10 minutes/ removes chlorophyll/ dip leaf in hot water/ softens leaf/ white tile/ cover with iodine/  
[Maximum of 2 × 3m from testing leaf]

*/Result:*

A – no change in colour;  
B – turns blue-black or black

*/Conclusion:* CO<sub>2</sub> is needed for photosynthesis

[Maximum of 15 marks if no result for plant **B** given]

[Some, or all, of marks in method may be obtained from labelled diagram]

**Any six**  $6 \times 3\text{m}$

**Or**

**Method B:**

Diagram:

(3m, 0m)

[For 3 marks diagram must show pond weed **and** suitable container **and** water]

Labels: pond weed or *Elodea*/ beaker or funnel or test tube/ water

3 × 1m

**Method**

Pondweed or *Elodea*/ suitable container/ label ~~test tubes~~ A and B/ reason why pondweed used/ add water to container(s)/ add excess sodium hydrogen carbonate to A/ why added/ no sodium hydrogen carbonate in B/ as control/ cut pondweed/ under water/ place pondweed in containers A and B/ place A and B in water baths/ maintain temp. at 25° C/ dark room/ light source/ allow pondweed to adjust/ count bubbles (of oxygen) coming from pondweed/

**/ Result:**

A – many bubbles (of oxygen) coming from pondweed; B - no (or very few) bubbles (of oxygen) coming from pondweed/

**/Conclusion:** CO<sub>2</sub> is needed for photosynthesis

[Maximum of **15** marks if no result for plant A given]

[Some, or all, of marks in method may be obtained from labelled diagram]

**Any six 6 × 3m**

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