Government of South Australia

SACE Board of SA

External Examination 2012

2012 AGRICULTURAL AND HORTICULTURAL SCIENCE

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SUPERVISOR CHECK

RE-MARKED

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Friday 9 November: 1.30 p.m.

Time: 2 hours

Pages: 23
Questions: 20

Examination material: one 23-page question booklet
one 8-page script book
one SACE registration number label

Approved dictionaries and calculators may be used.

Instructions to Students

1. You will have 10 minutes to read the paper. You must not write in your question booklet or script book or use a calculator during this reading time but you may make notes on the scribbling paper provided.

2. This paper is in two parts:

   Part 1: Short-answer Questions (Questions 1 to 18)
   Answer ***all*** questions in the spaces provided in this question booklet.

   Part 2: Extended-response Questions (Questions 19 and 20)
   Answer ***either*** Question 19 ***or*** Question 20.
   Write your answer in the separate script book.

3. In Part 1 there is no need to fill all the space provided; clear, well-expressed answers are required. If you delete part or all of an answer, you should clearly indicate your final answer and label it with the appropriate question number.

4. The allocation of marks and the suggested allotment of time are as follows:

Part 1	100 marks	95 minutes
Part 2	20 marks	25 minutes
Total	120 marks	120 minutes

5. Attach your SACE registration number label to the box at the top of this page. Copy the information from your SACE registration number label into the box on the front cover of your script book.

6. At the end of the examination, place your script book inside the back cover of this question booklet.

STUDENT'S DECLARATION ON THE USE OF CALCULATORS

By signing the examination attendance roll I declare that:

- my calculators have been cleared of all memory
- no external storage media are in use on these calculators.

I understand that if I do not comply with the above conditions for the use of calculators I will:

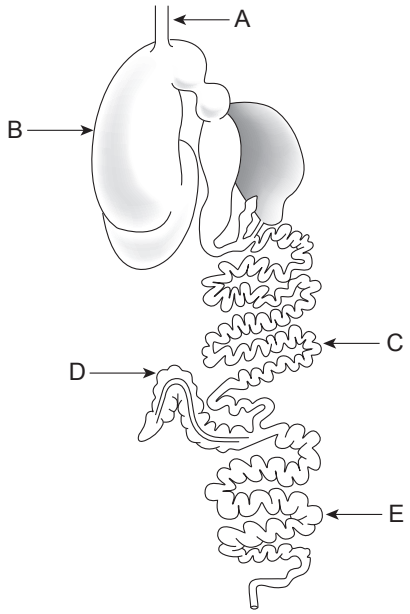
- be in breach of the rules
- have my results for the examination cancelled or amended
- be liable to such further penalty, whether by exclusion from future examinations or otherwise, as the SACE Board of South Australia determines.

PART 1: SHORT-ANSWER QUESTIONS (Questions 1 to 18)

(100 marks)

*Answer **all** questions in Part 1 in the spaces provided. The allocation of marks is shown in brackets at the end of parts of each question. You should spend about 95 minutes on this part.*

1. *Refer to the following diagram, which shows the digestive system of a sheep:*



Source: Adapted from an illustration by Di Booth in L. Brown, R. Hindmarsh & R. McGregor, *Dynamic Agriculture*, Book 3, 2nd edn, McGraw-Hill, Sydney, 2001, p. 106
Reprinted with the permission of Cengage Learning Australia P/L.

(a) Name the following four structures labelled on the diagram above.

Structure A: _____

Structure C: _____

Structure D: _____

Structure E: _____

(2 marks)

(b) Describe the process by which food moves through Structure A towards Structure B.

_____

_____ (1 mark)

(c) Describe *one* function of Structure E. _____

_____ (1 mark)

2. *Refer to the following tables, which show the food requirements of different classes of ewe and the food composition of three stock feeds:*

Table 1 — Metabolisable energy (ME) and protein requirements for ewes

Ewe condition	*ME requirement (MJ/day)*	*Protein requirement (g/day)*
40 kg store ewe	7.4	53
Pregnant ewe	8.2	79
Lactating ewe	16.3	213

Table 2 — Food composition per kilogram of dry matter

Feed	*ME content (MJ)*	*Protein content (%)*
Wheat grain	13.0	10
Lucerne hay	8.5	13
Oaten hay	9.3	5

(a) Explain why wheat grain is described as a 'concentrated feed' while lucerne hay is described as 'roughage'.

_____

_____ (1 mark)

(b) Describe *one* feeding technique adopted by livestock managers to ensure that lactating ewes gain sufficient energy to satisfy their daily requirements.

_____

_____ (1 mark)

(c) Use *two* factors to explain why a lactating ewe that is fed only oaten hay is unlikely to produce sufficient milk for her lamb.

Factor 1: _____

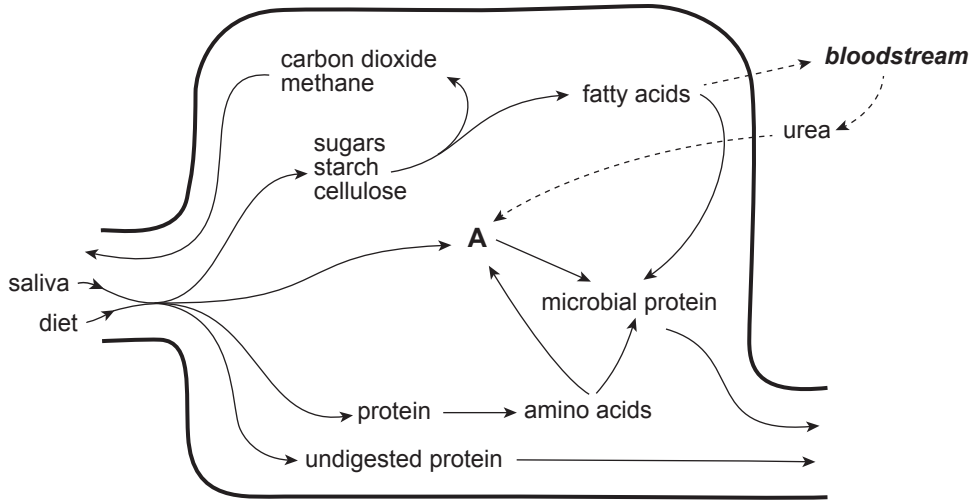
_____

Factor 2: _____

_____

(2 marks)

3. *Refer to the following diagram, which shows the digestive processes in the rumen of a farm animal:*



(a) Identify Product A. _____ (1 mark)

(b) Explain how a grazing animal with a rumen is able to grow even when eating poor-quality cereal stubble.

_____

_____

_____

_____ (2 marks)

(c) Explain why feedlot operators prefer to feed ruminants with proteins that are not broken down in the rumen.

_____

_____

_____

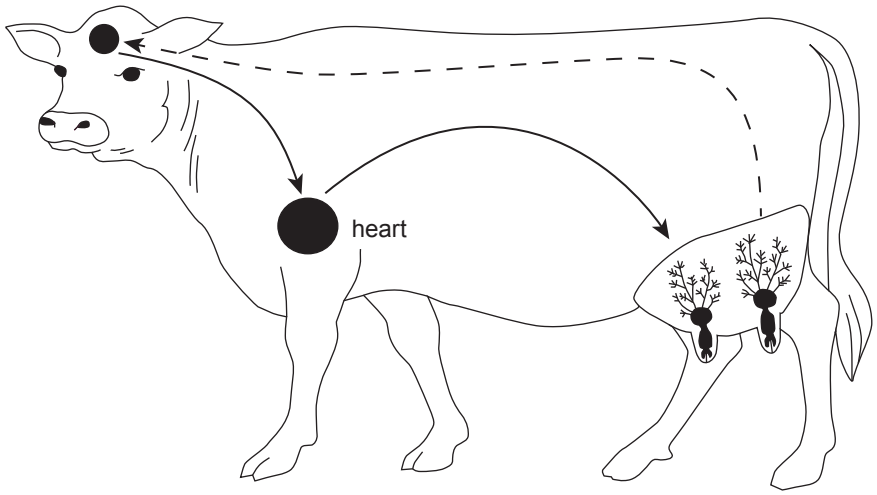
_____ (2 marks)

(d) Identify *one* method of protecting protein so that it passes undigested through the rumen.

_____

_____ (1 mark)

4. *Refer to the following diagram, which shows a lactating cow:*



Source: Adapted from an illustration by Di Booth in L. Brown, R. Hindmarsh & R. McGregor, *Dynamic Agriculture*, Book 3, 2nd edn, McGraw-Hill, Sydney, 2001, p. 147
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(a) Name the hormone that is responsible for milk letdown.

_____ (1 mark)

(b) Name the gland that releases this hormone.

_____ (1 mark)

(c) Explain the process of milk letdown in terms of the steps shown on the diagram.

_____

_____

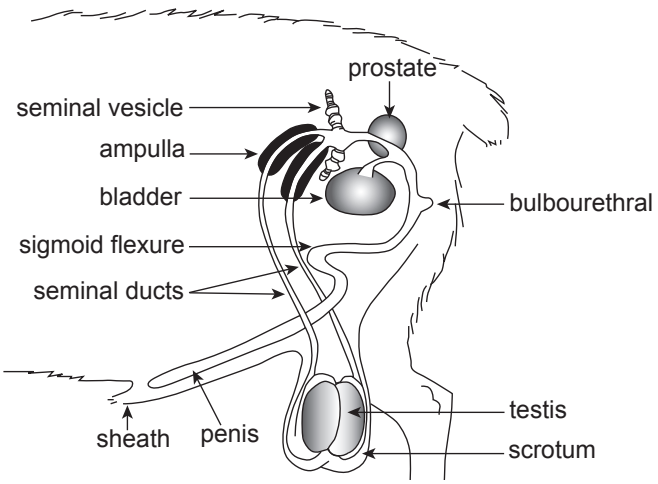
_____

_____

_____

_____ (3 marks)

5. (a) *Refer to the following diagram, which shows the reproductive tract of a ram:*



Source: Adapted from an illustration by Di Booth in L. Brown, R. Hindmarsh & R. McGregor, *Dynamic Agriculture*, Book 3, 2nd edn, McGraw-Hill, Sydney, 2001, p. 120
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(i) (1) Identify *two* components in the reproductive tract of a ram that are classified as 'accessory' glands.

Component 1: _____

Component 2: _____

(1 mark)

(2) Select *one* of these two glands and state its role in the reproductive process.

Gland: _____

Role: _____

_____ (1 mark)

(ii) Describe how semen can be collected from a ram and stored for use in artificial insemination.

_____

_____

_____

_____ (2 marks)

(b) Many processes form part of the animal reproductive cycle.

(i) Describe the difference between oestrus and the oestrous cycle.

_____

_____

_____

_____ (2 marks)

(ii) Explain why both copulation and ovulation must occur before natural fertilisation can take place.

_____

_____

_____

_____ (2 marks)

6. *Refer to the following photograph, which shows a sign to prevent unauthorised access to a property:*

(a) The sign refers to the Quarantine Act. Define the term 'quarantine'.

_____

_____ (1 mark)

(b) Suggest *one* reason why the manager would want to keep people and goods out.

_____

_____ (1 mark)

(c) Suggest the significance of the sign referring to the Quarantine Act compared with a sign that just says 'Keep out'.

_____

_____ (1 mark)

7. Avian paramyxovirus has recently been discovered in feral pigeon flocks in Victoria. Describe *two* biosecurity methods (other than quarantine) that could be used to prevent the virus spreading into commercial poultry flocks in South Australia.

(a) Method 1: _____

_____

_____ (1 mark)

(b) Method 2: _____

_____

_____ (1 mark)

8. (a) (i) Provide the scientific name of *one* micro-organism involved in a food or beverage production process.

_____ (1 mark)

(ii) Describe the role of the micro-organism named in part (a)(i).

_____

_____

_____

_____ (2 marks)

(b) State and explain *one* preservation method that might be used to prevent spoilage of food or beverage by an invertebrate.

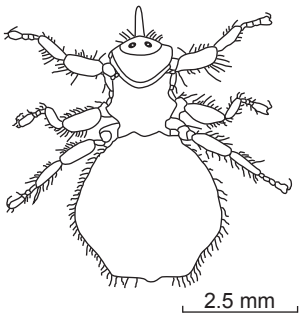
_____

_____

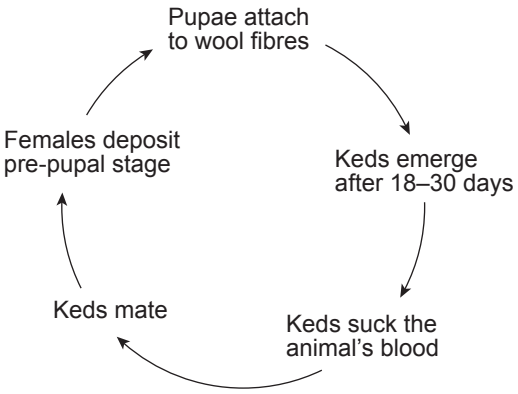
_____

_____ (2 marks)

9. *Refer to the following diagrams, which show an adult sheep ked and the life cycle of sheep keds:*



Adult sheep ked (*Melophagus ovinus*)



Source: Adapted from A. Clark, *Senior Australian Agriculture*, 2nd edn, Pascal Press, Glebe, 2001, p. 245

(a) Identify the invertebrate group to which sheep keds belong.

_____ (1 mark)

(b) Describe *two* practices that farmers may use to minimise damage caused by sheep keds to their flocks.

Practice 1: _____

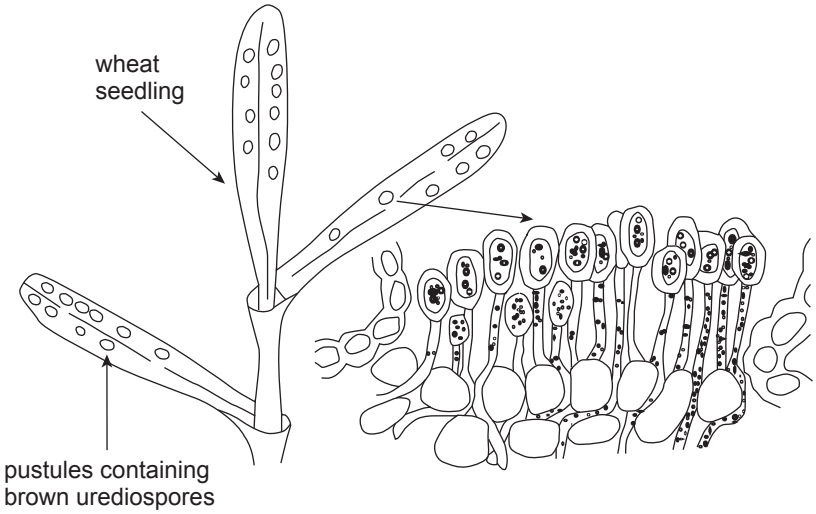
_____

Practice 2: _____

_____

(2 marks)

10. *Refer to the following diagram, which shows a wheat seedling affected by a disease:*



Source: Adapted from A. Clark, *Senior Australian Agriculture*, 2nd edn, Pascal Press, Glebe, 2001, p. 236

(a) Identify the type of micro-organism that is responsible for this disease.

_____ (1 mark)

(b) Explain how this type of micro-organism damages seedlings and how the damage leads to decreased agricultural production.

_____

_____

_____

_____

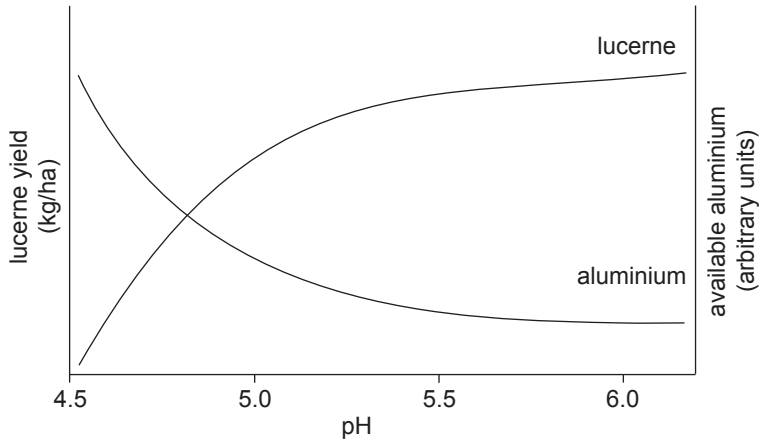
_____

_____

_____

_____ (4 marks)

11. *Refer to the following graph, which shows the effect of pH on lucerne yield and on the amount of available aluminium in the soil:*



(a) Describe the effect of pH on aluminium availability in the soil, and suggest a possible reason for this effect.

_____

_____

_____

_____ (2 marks)

(b) Describe the relationship between the amount of available aluminium in the soil and lucerne yield.

_____

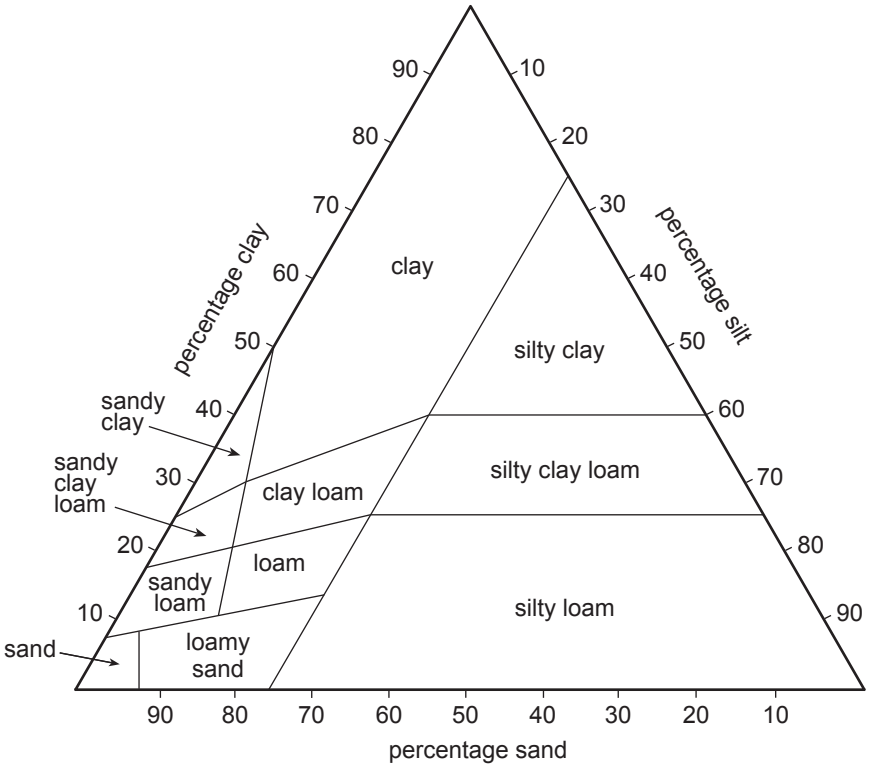
_____ (1 mark)

(c) Outline *one* management technique that a farmer could use to increase lucerne yield in acidic soils.

_____

_____ (1 mark)

12. *Refer to the following soil texture triangle, which shows texture composition of different soil types:*



Source: Adapted from D.A. Macleod *et al.*, *Soils and Climate in Agricultural Production Systems*, Australian Agriculture Series, Book 2, University of New England, 1984, p. 17

(a) Using the soil texture triangle, complete the missing spaces in the following table.

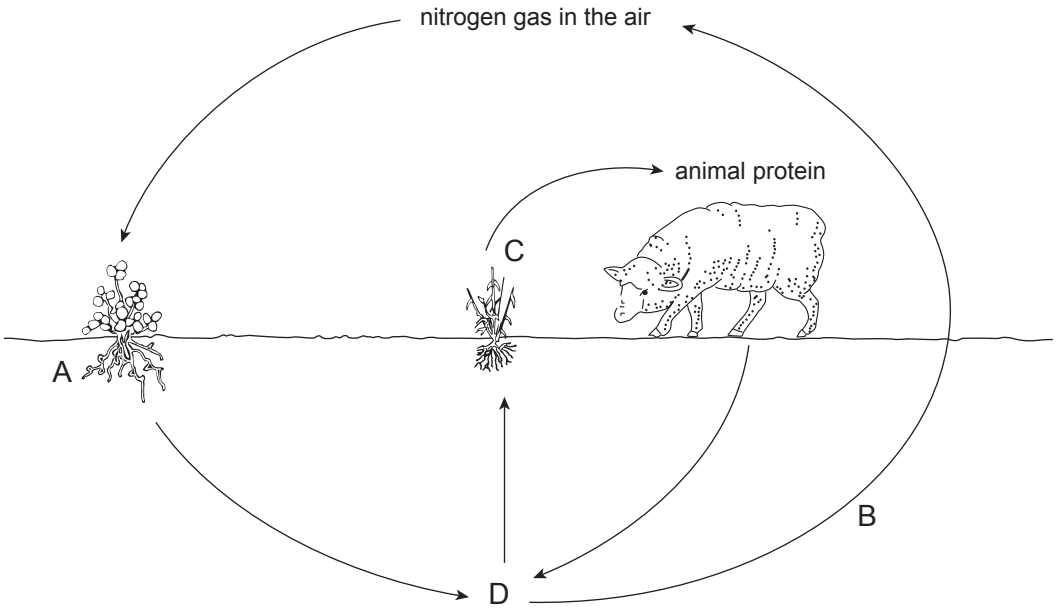
Soil type		*Sand (%)*	*Silt (%)*	*Clay (%)*
A	clay loam			
B		10	30	60

(2 marks)

(b) Explain which of the two soil types, A or B, would have the highest cation exchange capacity, using your knowledge of soil texture.

(2 marks)

13. *Refer to the following diagram, which represents the nitrogen cycle:*



(a) Identify the following processes and substances in the nitrogen cycle shown above.

Process A: _____

Process B: _____

Substance C: _____

Substance D: _____

(2 marks)

(b) Name *one* type of bacterium that plays an important role in the nitrogen cycle.

_____ (1 mark)

(c) A part of the nitrogen cycle not shown in detail in the diagram is the decomposition of organic residues. The decomposition process consists of three steps, beginning with oxidation. Identify and explain *one* of the remaining two steps.

Step name: _____

Explanation: _____

_____

_____

(2 marks)

(d) At times, natural methods are insufficient to maintain soil nitrogen levels and it is necessary to apply fertilisers.

(i) Identify *one* fertiliser that a farmer could apply to remedy low soil nitrogen.

_____ (1 mark)

(ii) Explain *one* problem that may occur when a farmer applies this fertiliser.

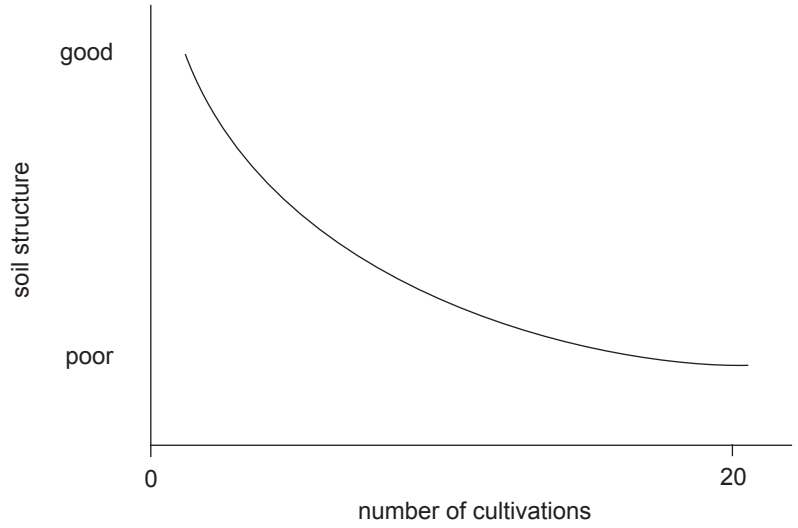
_____

_____

_____

_____ (2 marks)

14. *Refer to the following graph, which shows the effect of soil cultivations on soil structure:*



(a) Describe the effect that the number of cultivations has on soil structure.

_____

_____ (1 mark)

(b) Explain the probable effects of excessive cultivation on the porosity, water percolation, and nutrient-holding capacity of a soil.

(6 marks)

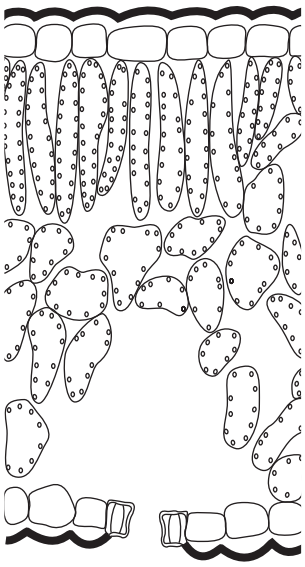
(c) In terms of soil structure, explain how the soil type determines whether minimum tillage or zero tillage is used.

(2 marks)

15. If a paddock has salt scald, farmers are sometimes advised to plant saltbush. Explain how growing saltbush may overcome the problem and give *one* other advantage of using this plant.

(3 marks)

16. *Refer to the following diagram, which shows the structures found inside a leaf:*



(a) On the diagram above, clearly label the following *two* structures:
- cuticle
- spongy mesophyll.

(1 mark)

(b) (i) If a hot, dry wind begins to blow, explain the response that the plant will initiate to protect itself from water loss.

_____

_____

_____

_____ (2 marks)

(ii) Identify the plant hormone that is largely responsible for initiating the response explained in part (b)(i).

_____ (1 mark)

(c) Explain the processes of photosynthesis and respiration in leaves. Include in your answer an equation for photosynthesis and name the part of the cell where photosynthesis occurs.

(6 marks)

17. The reproductive processes in plants can be sexual or asexual.

(a) (i) Draw a dicotyledonous flower. Label *six* reproductive structures.

(4 marks)

(ii) For *two* of the reproductive structures labelled on your diagram, describe their role in the reproductive process.

(1) Structure 1: _____

Role: _____

_____ (1 mark)

(2) Structure 2: _____

Role: _____

_____ (1 mark)

(b) Describe *one* advantage and *one* disadvantage of vegetative (asexual) reproduction.

Advantage: _____

_____

_____

Disadvantage: _____

_____

_____

(2 marks)

(c) Name *two* common agricultural or horticultural plants that usually reproduce asexually.

Plant 1: _____

Plant 2: _____

(1 mark)

(d) In horticulture, tissue culturing uses asexual reproductive processes to produce clones. Explain the benefits to the horticultural industry of using tissue culture to produce clones.

_____

_____

_____

_____

_____

_____ (3 marks)

18. (a) Nitrogen, phosphorus, and potassium are key macronutrients in plants. In the table below, insert each macronutrient in the box next to its major function.

Macronutrient	*Major function*
	Involved in energy metabolism
	Key component in amino acids and plant enzyme production
	Enhances most plant processes, especially flowering

(1 mark)

(b) Select *one* of the macronutrients listed in part (a) and describe the common symptoms observed in plants with a deficiency of this macronutrient.

Macronutrient: _____

Deficiency symptoms: _____

_____

_____ (2 marks)

(c) Select *one* macronutrient ***not*** listed in part (a) and outline its role in plant growth.

Macronutrient: _____

Role: _____

_____

_____ (2 marks)

PART 2: EXTENDED-RESPONSE QUESTIONS (Questions 19 and 20)

(20 marks)

*Answer **either** Question 19 **or** Question 20.*

Write your answer in the separate script book provided.

You should spend about 25 minutes on this part. Credit will be given for clear, well-expressed answers that are well organised and relevant to the question.

19. The proposed Murray–Darling Basin Plan may eventually lead to less water being available to irrigators in the Basin. With reduced allocations, some irrigators may choose to sell their water entitlements and switch to dryland farming.
    - Describe *one* effect that a reduction of water application may have on soil fauna, and explain how this effect may lead to changes in soil structure.
    - Identify and explain *one* possible effect of reduced water application on plant production, and describe a change that irrigators can implement to minimise the impacts of reduced water application.
    - Explain *one* effect of reduced plant production on livestock production, and describe *one* method that could be implemented to reduce this effect.
    - Provide *two* reasons to explain how reducing irrigation could be beneficial to the environment.

20. Due to limited availability of land and the need to feed a growing world population, many plant and animal production enterprises are now carried out intensively. These production systems, while having many benefits, tend to be input intensive and often have disadvantages.
    - Describe *one* possible effect of intensive plant production on the choice of plant varieties or types grown, and explain how this may lead to a reduction in overall plant production.
    - Animals in intensive production systems are normally provided with the required amounts of minerals and vitamins in a controlled diet. Identify and explain a possible effect of a deficiency of *one* mineral and *one* vitamin on animals or birds in an intensive production system.
    - Explain *one* effect of intensive animal systems that may be negative for the soil or soil processes, and describe *one* method that could be used to limit this effect.
    - Required inputs for intensive production systems are usually very high. Use *two* examples to explain whether these systems are a sustainable form of agricultural production.