NSW Education Standards Authority

2021 **HIGHER SCHOOL CERTIFICATE EXAMINATION**

Agriculture

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used

Total marks: 100

Section I – 80 marks (pages 2–24)

This section has two parts, Part A and Part B

Part A – 20 marks

- Attempt Questions 1–20
- Allow about 30 minutes for this part

Part B – 60 marks

- Attempt Questions 21–27
- Allow about 1 hour and 45 minutes for this part

Section II – 20 marks (pages 25–26)

- Attempt ONE question from Questions 28–30
- Allow about 45 minutes for this section

Section I
80 marks

Part A – 20 marks
Attempt Questions 1–20
Allow about 30 minutes for this part

Use the multiple-choice answer sheet for Questions 1–20.

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1 Part of a label on an insecticide container is shown.

Crop	*Insect*	*State*	*Application rate* (L/ha)
Cotton	Helicoverpa	NSW, QLD	3
	Aphids	QLD	2.8
Eggplant	Aphids	All states	2.8
Field peas	Aphids	NSW	2
		QLD	2.5
	Leafhoppers	All states	2.5

What is the correct application rate for this insecticide to target aphids on field peas in New South Wales?

A. 2 L/ha

B. 2.5 L/ha

C. 2.8 L/ha

D. 3 L/ha

2 What is the purpose of a grassed waterway?

A. To cut for silage

B. To use as a fodder crop

C. To trap sediment and debris

D. To allow for stock movement

3 What is the end point of a marketing chain?

A. Consumer

B. Processor

C. Producer

D. Retailer

4 A producer sells their product at a farm gate stall.

Which of the following strategies is the producer using?

A. Contract selling

B. Direct marketing

C. Vertical integration

D. Cooperative marketing

5 A student assesses the size, shape and arrangement of soil peds in a sample.

What characteristic of the soil is being assessed?

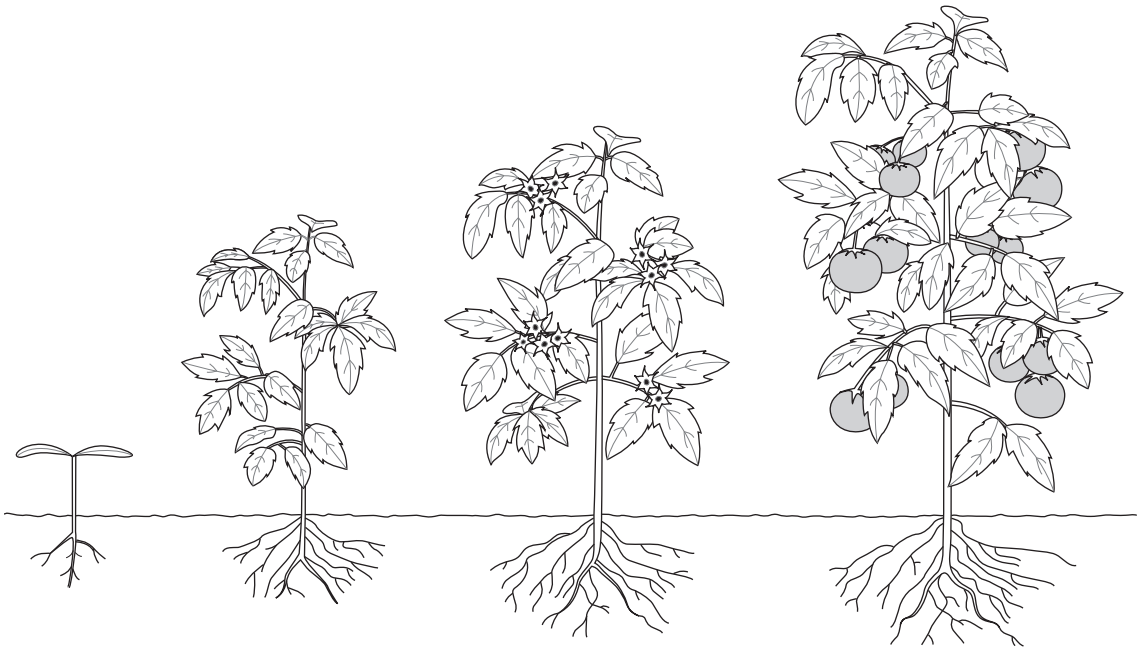
A. Texture

B. Porosity

C. Structure

D. Bulk density

6 The development phases of a plant are shown.



Which is the vegetative phase of growth in this representation?

A. *Q*

B. *R*

C. *S*

D. *T*

7 Which of the following equations represents photosynthesis?

A. $\text{Oxygen} + \text{water} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \text{glucose} + \text{carbon dioxide}$

B. $\text{Oxygen} + \text{glucose} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \text{carbon dioxide} + \text{water}$

C. $\text{Carbon dioxide} + \text{water} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \text{glucose} + \text{oxygen}$

D. $\text{Carbon dioxide} + \text{glucose} \xrightarrow[\text{sunlight}]{\text{chlorophyll}} \text{oxygen} + \text{water}$

8 Some types of plants establish a relationship with particular micro-organisms to form root nodules that provide the plant with a nutrient.

Which row of the table correctly connects the type of plant, micro-organism and the associated nutrient in this process?

	Type of plant	*Micro-organism*	*Associated nutrient*
A.	Cereal	Rhyzome	P
B.	Legume	Rhyzome	P
C.	Cereal	Rhyzobium	N
D.	Legume	Rhyzobium	N

9 Which soil characteristic is NOT influenced by the level of organic matter in the soil?

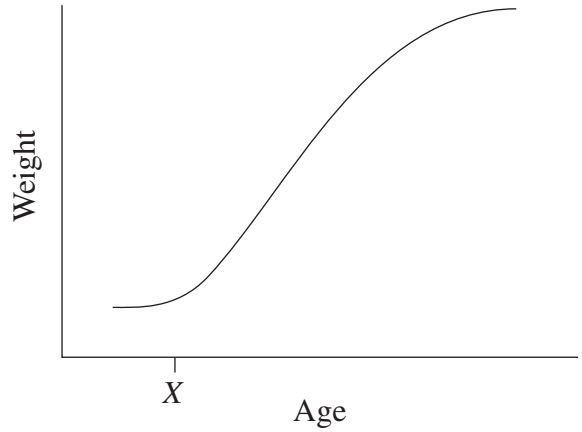
A. pH

B. Texture

C. Structure

D. Ion exchange capacity

10 The graph shows a typical growth curve for an animal.



What is the best type of diet to feed an animal at age *X* in its growth?

A.	High protein	Low energy
B.	High protein	High energy
C.	Low protein	Low energy
D.	Low protein	High energy

11 There are several techniques available for farmers to manipulate reproduction in farm animals.

Which of the following would have the least impact on an animal's welfare?

A. Flushing

B. Embryo transfer

C. Artificial insemination

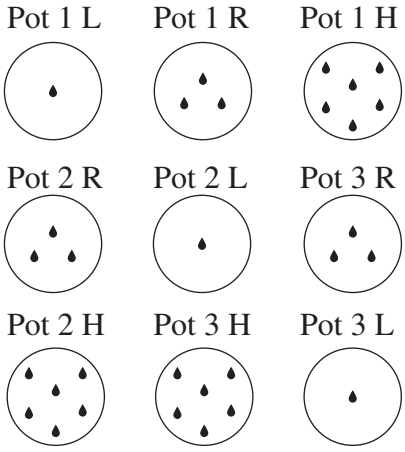
D. Oestrus synchronisation

Use the following information to answer Questions 12–14.

A student conducted a trial to determine the effect of planting density on the yield of radishes.

Nine identical pots were set up using the same potting mix. Radish seedlings from one tray were planted into the pots using three different densities: low, recommended and high.

The pots were placed in the school glasshouse as shown, under automated misters.



Treatment key

(L) Low density: one seedling

(R) Recommended density: three seedlings

(H) High density: six seedlings

After six weeks the radishes were harvested and the dry matter yield of each treatment was measured and recorded.

12 Which element is the *control* in this experimental design?

A. The use of three identical pots per treatment

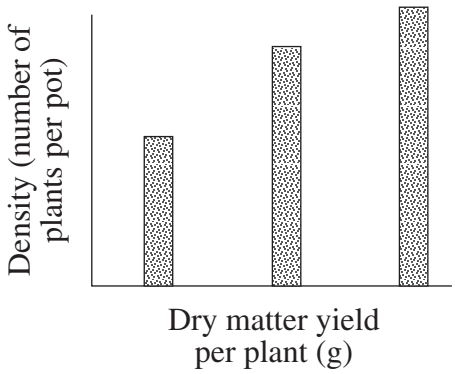
B. The arrangement of pots, as depicted in the diagram

C. The inclusion of the recommended density as one of the treatments

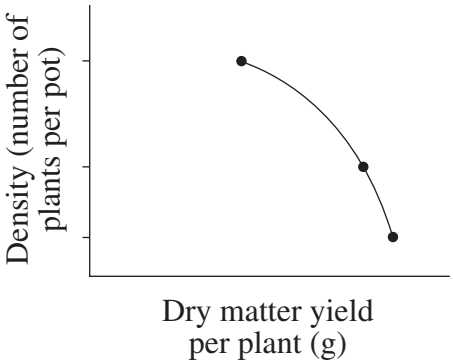
D. The placement of identical pots in a glasshouse with equal water application

13 Which of the following would be the best format to graphically represent the results of this trial?

A.



B.



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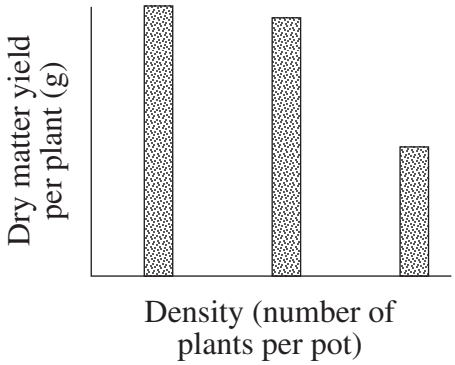
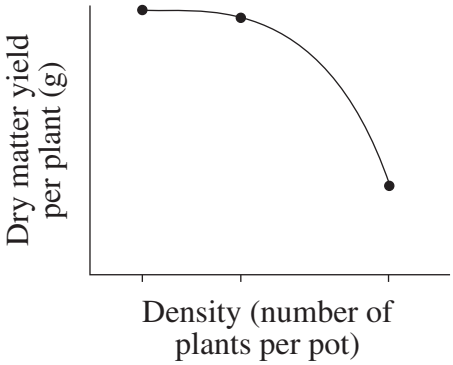


D.



14 The table shows the dry matter yield (dm) following the six-week trial.

Pot number	*Low density* (g dm/pot)	*Recommended density* (g dm/pot)	*High density* (g dm/pot)
1	1.5	4.8	4.8
2	1.7	4.2	4.8
3	1.5	4.8	4.4

What is the mean dry matter yield per plant for the recommended density?

A. 1.53 g

B. 4.6 g

C. 4.8 g

D. 13.8 g

15 Which external influence on agricultural production is enforceable by law?

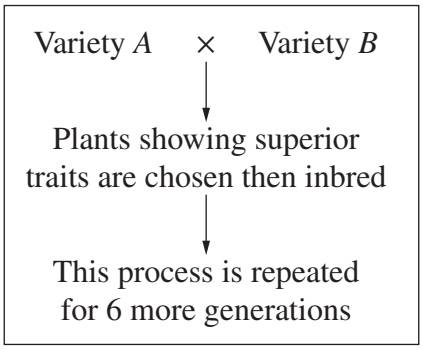
A. Legislation

B. Code of practice

C. Code of conduct

D. Industry standard

16 The breeding system for a plant improvement program is shown.



What is the name of this breeding system?

A. Line breeding

B. Crossbreeding

C. Hybrid breeding

D. Selective breeding

17 Which combination of conditions is ideal to promote microbial fermentation in the rumen of an animal?

A. Slightly basic and aerobic

B. Slightly acidic and aerobic

C. Slightly basic and anaerobic

D. Slightly acidic and anaerobic

18 A farmer grew a crop of cabbages at four different densities to determine the best density for the crop.

The results of the trial are shown.

Plant density (plants/m^2)	*Input costs* ($/$m^2$)	*Value of harvested plants* ($/plant)
2	1.00	3.00
4	2.00	3.00
6	3.00	1.00
8	4.00	0.50

Based on these results, which is the most profitable density of cabbages for this farmer?

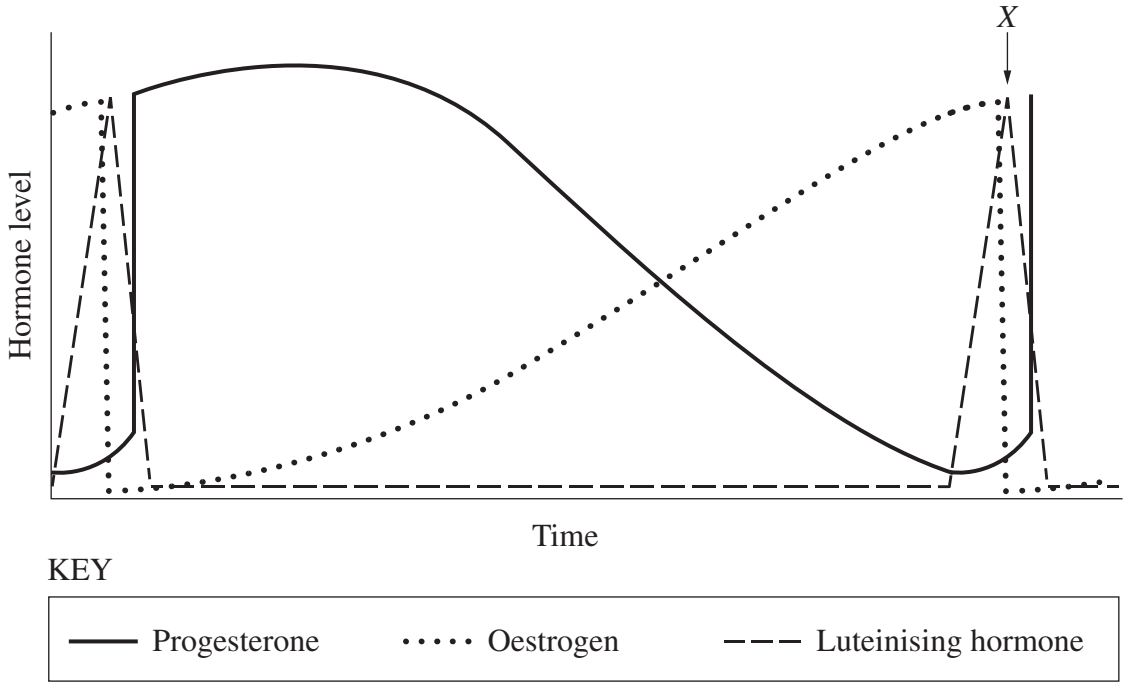
A. 2 plants/m^2

B. 4 plants/m^2

C. 6 plants/m^2

D. 8 plants/m^2

19 Variations in hormone levels for an animal are shown.



What is occurring at point *X*?

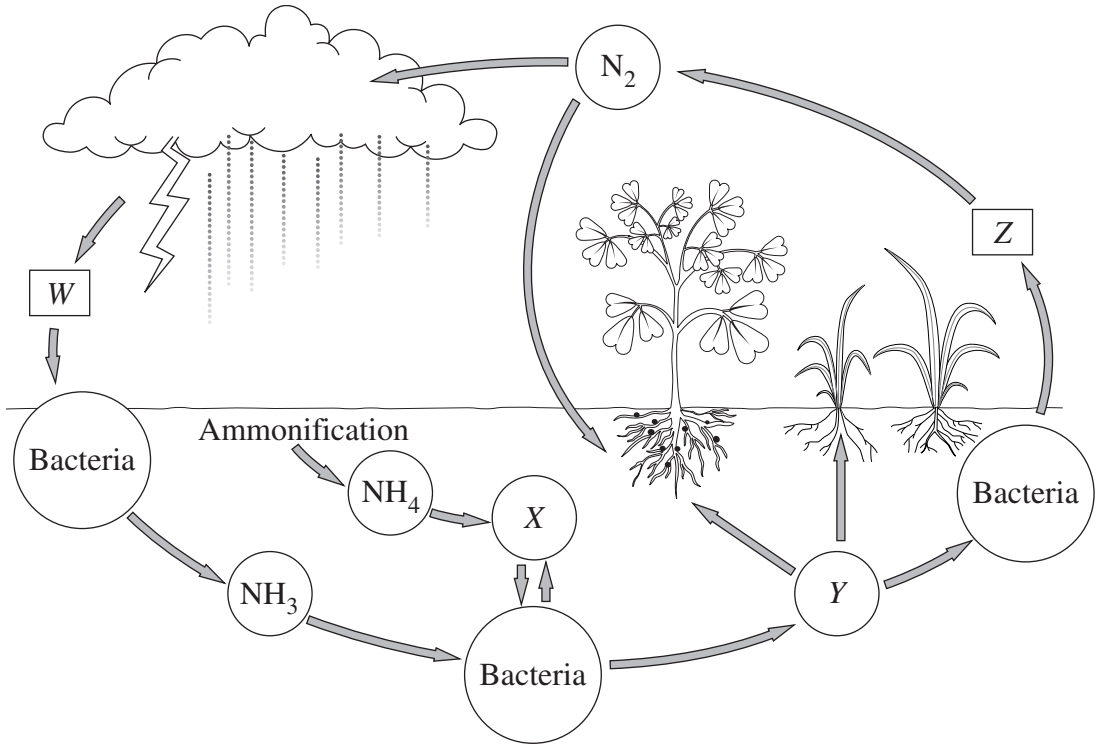
A. Birth

B. Fertilisation

C. Lactation

D. Ovulation

20 The diagram shows a nitrogen cycle, with four of the components labelled *W*, *X*, *Y* and *Z*.



Which row of the table correctly names components *W*, *X*, *Y* and *Z*?

	W	*X*	*Y*	*Z*
A.	Denitrification	Nitrite	Nitrate	Nitrification
B.	Denitrification	Nitrate	Nitrite	Nitrification
C.	Nitrification	Nitrite	Nitrate	Denitrification
D.	Nitrification	Nitrate	Nitrite	Denitrification

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2021 HIGHER SCHOOL CERTIFICATE EXAMINATION

Centre Number

Student Number

Agriculture

Section I Part B
Answer Booklet

60 marks
Attempt Questions 21–27
Allow about 1 hour and 45 minutes for this part

Instructions

- Write your Centre Number and Student Number at the top of this page.
- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Show all relevant working in questions involving calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 21 (6 marks)

(a) Outline how ONE management practice has contributed to a soil degradation problem. **2**

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(b) Explain how ONE procedure alleviates a soil degradation problem and ensures the long-term sustainability of the soil. **4**

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Question 22 (8 marks)

(a) Describe the roles of both grasses and non-grasses in a pasture mix. **4**

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(b) Discuss the use of native plant species in grazing systems. **4**

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Question 23 (8 marks)

(a) Complete this table in relation to livestock breeding systems. **4**

	Line breeding	*Crossbreeding*
Features of the breeding system	....	Animals of different lines or breeds are bred together. Each line or breed has desirable characteristics.
Outcome of the breeding system and its industry use	Offspring are uniform in appearance and are similar to the parents as well. This is widely used in the stud breeding industry.	....

Question 23 continues on page 17

Question 23 (continued)

(b) Describe the role of objective measurement in a livestock breeding system in relation to one specific industry. **4**

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End of Question 23

Question 24 (8 marks)

Answer parts (a)–(b) with reference to a product you have studied.

Name of product: .....

(a) Outline steps in the processing of this product from its raw state into a different form. **3**

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(b) Explain the concept of *value adding*, using a specific example for this product. **5**

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Question 25 (9 marks)

(a) Why are market specifications important in the marketing of a product? **3**

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(b) Explain strategies a producer can use to meet ONE specific market specification for a product. **6**

Name of product: .....

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Question 26 (11 marks)

Answer parts (a)–(c) with reference to ONE animal pest/disease that you have studied in relation to an integrated pest management (IPM) program.

Name of the animal pest/disease: .....

(a) Outline the signs or symptoms of this animal pest/disease. **2**

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(b) Explain why this animal pest/disease is significant to the industry. **3**

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Question 26 continues on page 21

Question 26 (continued)

(c) Evaluate an integrated pest management (IPM) program for the identified animal pest/disease. **6**

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End of Question 26

Question 27 (10 marks)

(a) Outline how a farmer's decisions are affected by both the irregular nature of their income and the necessity for high expenditure on inputs. **4**

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(b) Discuss the use of gross margins in on-farm financial planning. **6**

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Section I Part B extra writing space

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Agriculture

Section II

20 marks
Attempt ONE question from Questions 28–30
Allow about 45 minutes for this section

Answer the question in the Section II Writing Booklet. Extra writing booklets are available.

Your answers will be assessed on how well you:

- demonstrate knowledge and understanding relevant to the question
- communicate ideas and information using relevant examples
- present a logical and cohesive response

Question 28 — Agri-food, Fibre and Fuel Technologies (20 marks)

Answer part (a) of the question on pages 2–4 of the Writing Booklet.

(a) In this elective you analysed a research study of the development and/or implementation of one agricultural biotechnology.

(i) Outline the purpose of the research study that you analysed. **3**

(ii) Describe the conclusions and recommendations of this research study. **5**

Answer part (b) of the question on pages 5–8 of the Writing Booklet.

(b) Discuss biofuel production in relation to world food demands and the efficient use of carbon. **12**

OR

Please turn over

Question 29 — Climate Challenge (20 marks)

Answer part (a) of the question on pages 2–4 of the Writing Booklet.

(a) In this elective you analysed a research study of climate variability or management strategies related to climate variability.

(i) Outline the purpose of the research study that you analysed. **3**

(ii) Describe the conclusions and recommendations of this research study. **5**

Answer part (b) of the question on pages 5–8 of the Writing Booklet.

(b) Explain how ruminant livestock produce greenhouse gases and how these emissions could be reduced. **12**

OR

Question 30 — Farming for the 21st Century (20 marks)

Answer part (a) of the question on pages 2–4 of the Writing Booklet.

(a) In this elective you analysed a research study of the development and/or implementation of one recent agricultural technology.

(i) Outline the purpose of the research study that you analysed. **3**

(ii) Describe the conclusions and recommendations of this research study. **5**

Answer part (b) of the question on pages 5–8 of the Writing Booklet.

(b) Discuss developments in both robotics and biotechnology. Support your answer with current agricultural examples. **12**

End of paper