NSW Education Standards Authority

2020 **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 25–27)

- 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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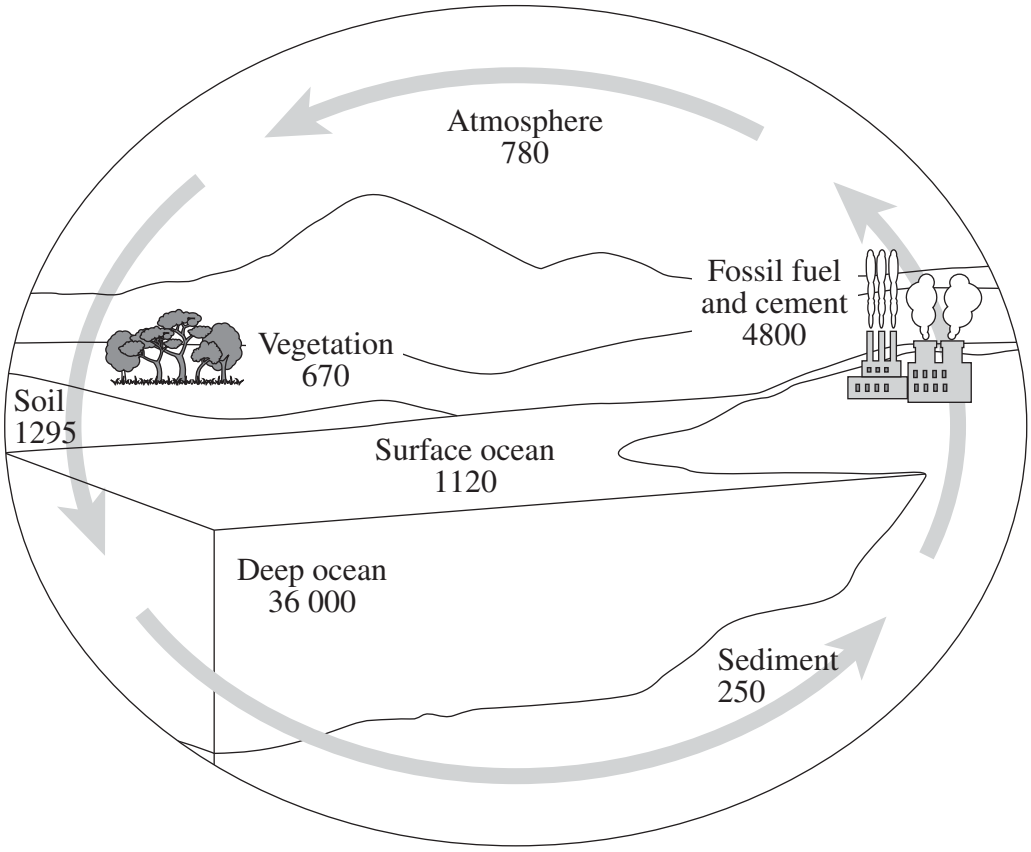
1 The diagram shows a carbon cycle and the mass of carbon, in gigatonnes, in each component.



Based on the diagram, which of the following shows carbon sinks in decreasing order of mass?

A. Soil, surface ocean, vegetation, sediment

B. Vegetation, surface ocean, soil, deep ocean

C. Sediment, soil, deep ocean, fossil fuel and cement

D. Deep ocean, fossil fuel and cement, vegetation, soil

2 Which of the following features of soil cannot be changed by management practices?

A. Water-holding capacity

B. Nutrient status

C. Structure

D. Texture

3 A soil has a measured pH of 5.1.

Which treatment would be the most effective in making this soil more productive?

A. Deep rip the soil to at least 40 cm.

B. Spread lime onto the soil and incorporate it into the soil.

C. Add organic matter to the soil by incorporating a green manure crop.

D. Add gypsum to the soil and allow the gypsum to incorporate naturally over time.

4 When undertaking an animal husbandry practice on a farm, there are many factors to consider in order to reduce any negative impact on the welfare of the animal.

Which of the following is NOT one of these factors?

A. Skill of the operator

B. Timing of the animal practice

C. Cost of carrying out the practice

D. Use of the appropriate equipment

5 Why does the use of artificial insemination lead to increased genetic gain in a livestock enterprise?

A. The males used are usually superior to other males.

B. It is a more reliable method of producing a pregnancy.

C. More young can be produced than through conventional breeding.

D. Only a few males will contribute genetically to the next generation.

6 The following is a description of a marketing strategy.

> A group of dairy farmers in a district supply their milk to a processing factory. The group of farmers hold shares in the processing factory and make all decisions on marketing.

What is the name of this marketing strategy?

A. Cooperative

B. Contract selling

C. Direct marketing

D. Vertical integration

7 Which of the following determines *net assimilation rate*?

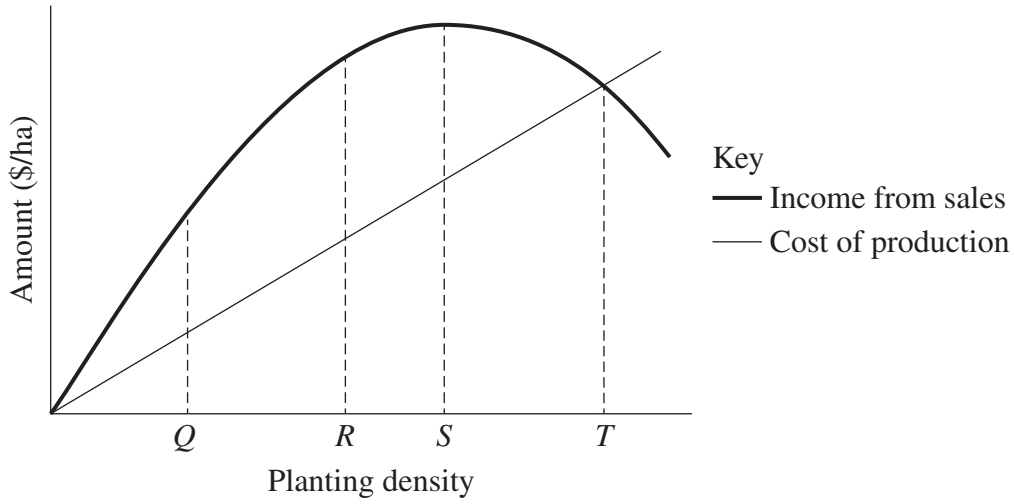
A. Respiration minus water uptake

B. Photosynthesis minus respiration

C. Nutrient uptake minus photosynthesis

D. Water uptake minus evapotranspiration

8 The graph shows the relationship between planting density for a grain crop, the income from sales of the crop in $/ha and the associated costs of its production in $/ha.



Which of the following is the best planting density to maximise the profit from this crop?

A. *Q*

B. *R*

C. *S*

D. *T*

9 Nutrition can influence the reproductive performance of an animal.

Which of the following is NOT affected by nutrition?

A. Season in which the animal mates

B. Production of ova and spermatozoa

C. Maintenance and growth of the foetus

D. Age at which the animal reaches puberty

10 Why would a producer include native species in their pasture mix?

A. To comply with government legislation

B. To provide refuge and feed for native animals

C. To provide the animals with a greater variation in their diet

D. To remain productive at times of adverse conditions for introduced species

11 Soil microorganisms have various roles in the soil.

In which of the following are three of these roles listed?

A. Build humus, lock up nutrients, improve soil texture

B. Break down humus, create soil structure, promote plant growth

C. Build organic matter, leach nutrients, glue soil minerals together

D. Return nutrients to mineral form, break down organic matter, fix nitrogen

12 Which of the following best describes integrated pest management (IPM)?

A. It uses intensive monitoring of pest populations to identify the best time and method of chemical control.

B. It is a way of controlling pests using certified organic methods and products to completely avoid using harmful synthetic pesticides.

C. It uses a combination of practices and control methods with the aim of preventing problems from occurring and reducing the need for pesticide-intensive activities.

D. It is a strategy used to prevent the build-up of pesticide resistance in pest populations, by rotating through chemical groups with different modes of action.

13 Why would a farmer undertake *line breeding* for ten consecutive years in their livestock production system?

A. To breed a herd with increased heterosis

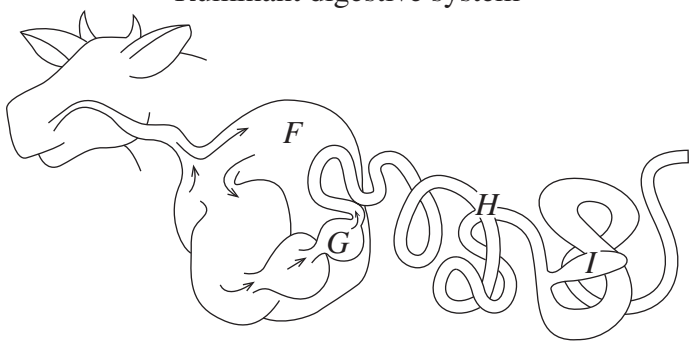
B. To improve hybrid vigour in progeny for sale

C. To produce sires which target different markets

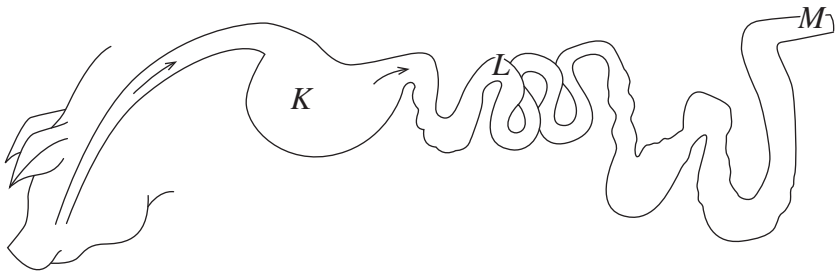
D. To develop genetically consistent breeding females

14 The diagram shows labelled organs in ruminant and monogastric digestive systems.

Ruminant digestive system



Monogastric digestive system



Which row of the table shows organs within the two digestive systems which have a similar function and organs which have a different function?

	Similar function	*Different function*
A.	*G* and *K*	*I* and *M*
B.	*G* and *K*	*H* and *L*
C.	*F* and *K*	*I* and *M*
D.	*F* and *K*	*H* and *L*

15 For ruminant animals, there are many steps involved in the digestion of gross energy in food until it is converted into production energy for harvesting as an animal product.

Which of the following identifies ONLY the losses of energy during this process?

A. Faeces, digestible energy, methane, urine

B. Faeces, body heat, methane, net energy

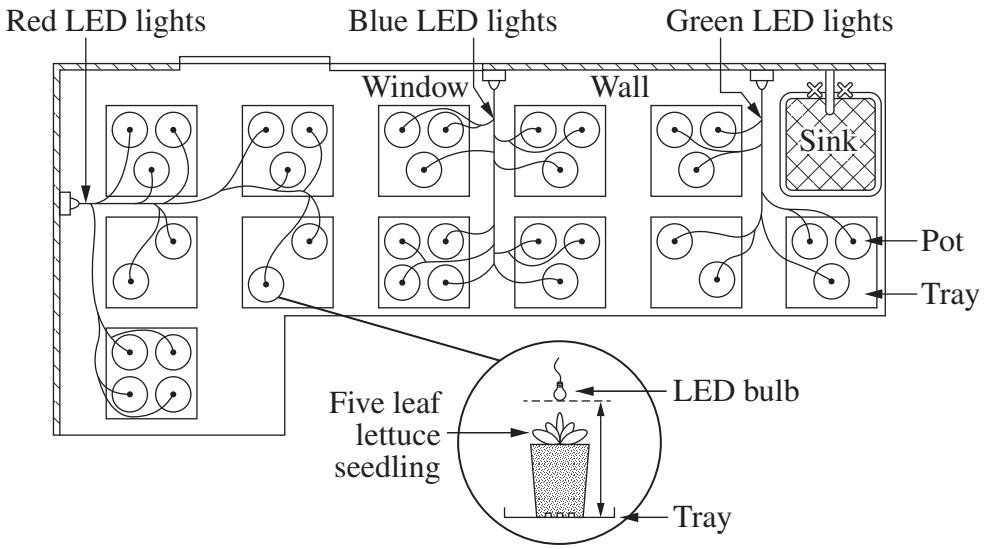
C. Faeces, body heat, maintenance energy, urine

D. Body heat, metabolisable energy, methane, urine

Refer to the following diagram to answer Questions 16 and 17.

A student performed a trial to determine the effect of the wavelength (colour) of light on plant yield.

The diagram depicts the trial set up on a laboratory bench in the student's classroom.



- All pots are the same, filled with the same soil and containing a lettuce plant at the five-leaf stage.
- Pots sit in identical trays and are lit by a coloured LED bulb of the same light intensity, in one of the three colours shown, suspended at the same height.
- The trial was conducted for two weeks and during that period water was added to each tray. Each tray received the same amount of water at the same time.

16 What element of experimental design has the student correctly applied?

A. Control

B. Randomisation

C. Replication

D. Standardisation

17 What would be the most valid measurement for the student to take at the conclusion of the trial?

A. Leaf colour

B. Plant height

C. Leaf number

D. Plant dry weight

18 A farmer has a 100-ha enterprise consisting only of oats.

A list of diary entries for the enterprise is shown.

Costs	
• Sowing	$8 100
• Chemical application	$4 500
• Harvesting	$5 000
• Local land services rates	$2 500
Income	
• Oats (grain)	$30 800
• Oaten stubble	$12 000
• Share dividends	$8 800

What is the gross margin ($/ha) for the enterprise?

A. $227.00

B. $252.00

C. $315.00

D. $340.00

19 An animal producer has a direct market contract with a major retail chain. When selling a group of animals, the producer can maximise returns if all the animals in the group are heavy and consistent in weight.

A feed company conducted a trial to determine the effect of several feed supplements on the growth of the animal species.

The results are summarised in the table below.

Supplement	*Mean weight* (kg)	*Standard deviation*
W	40	3.5
X	44	4.4
Y	46	3.7
Z	47	5.0

Based on these results, which would be the best supplement for the producer to use to maximise returns?

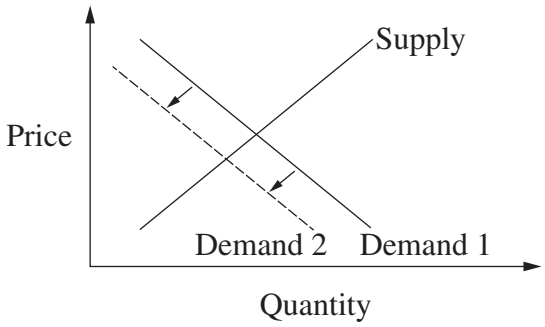
A. *W*

B. *X*

C. *Y*

D. *Z*

20 The graph shows the supply and demand information for a fresh horticultural product.



Which of the following is the most likely cause of the change depicted in the graph?

A. A contaminant was found in the product.

B. A natural disaster destroyed much of the national crop.

C. Product from an overseas producer flooded the local market.

D. Recent research studies indicated significant health benefits from consumption of the product.

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2020 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 (9 marks)

Answer parts (a)–(c) with reference to a soil degradation problem you have studied.

Name of problem: .....

(a) Outline the named problem. **2**

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(b) Explain how a land use practice has led to this problem. **3**

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(c) Explain how a sustainable management practice can alleviate this problem. **4**

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Question 22 (7 marks)

(a) Describe a marketing chain for an agricultural product that you have studied. **3**

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(b) Describe TWO ways in which government can influence the production of agricultural products in Australia. In your answer, include specific examples. **4**

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Question 23 (8 marks)

Answer parts (a)–(b) with reference to a named plant pest or disease and a plant it affects.

Name of pest or disease: ..... Plant affected: .....

(a) Describe the effect that the pest or disease has on the plant. **3**

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(b) Explain how a producer can manage both the plant and the environment to reduce or eliminate the impact of the pest or disease. **5**

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Question 24 (13 marks)

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

Name of product: .....

(a) Describe a way of *value adding* to the product at some stage in the marketing chain. **3**

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(b) Explain how farm management decisions can be influenced by the assessment of the quality of the product. Use specific examples linked to stated quality criteria. **4**

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Question 24 continues on page 18

Question 24 (continued)

(c) Assess an advertising or promotional campaign for the product. **6**

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End of Question 24

Question 25 (8 marks)

(a) Outline a process which occurs in the rumen. **2**

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(b) Feed rations for an animal vary depending on the stage of the animal's production cycle. **6**

Explain the variation in feed rations for a specific animal. Support your answer with reference to specific examples of dietary requirements throughout the production cycle.

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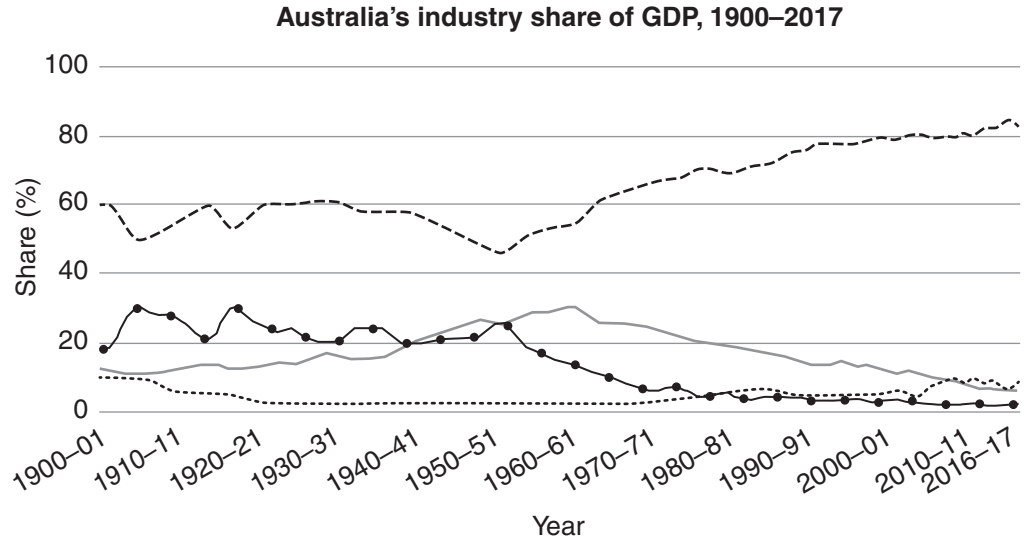
Question 26 (5 marks)

(a) The diagram shows the contribution by selected industry sectors to Australia's Gross Domestic Product (GDP), 1900–2017. **2**



Based on the diagram, outline the changes in the Agriculture sector's contribution to the GDP, relative to other sectors.

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(b) Contrast the business structure of *the family farm* to that of *the corporate enterprise*. **3**

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Question 27 (10 marks)

(a) Fill in the four cells to complete the table on plant and animal hormones. **4**

	Hormone name	*One effect of the hormone*
Plant hormone	Auxin	.....
	.....	Triggers stomatal closure
Animal hormone	.....	Stimulates release of an ova from ovary (ovulation)
	Oestrogen	.....

(b) Discuss *embryo transfer* in terms of both hormonal treatment and economic factors. **6**

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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) (i) Define the term *genetic engineering*, including an example. **2**

(ii) Explain the use of gene markers in agricultural production. **6**

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

(b) Analyse the conflict between ethical concerns and increasing agricultural production in relation to ONE biotechnology innovation. **12**

OR

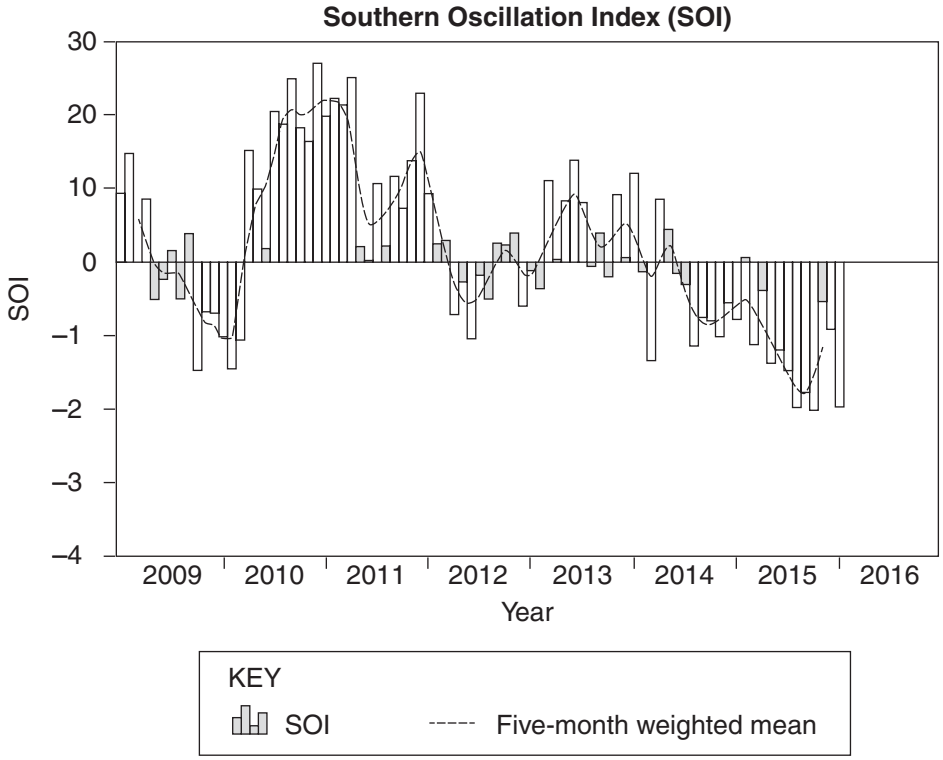
Please turn over

Question 29 — Climate Challenge (20 marks)

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

(a) (i) What is the Southern Oscillation Index? **2**

(ii) The diagram shows the monthly Southern Oscillation Index (SOI) 2009–2016. **6**



With reference to the diagram, describe the trend of El Niño events and the implications of these events for Australian agriculture.

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

(b) Analyse issues related to water storage and water trading in Australian agriculture. **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) (i) Outline a funding source available for the research and development of new agricultural technologies. **2**

(ii) Discuss patents in relation to research and development of agricultural technologies. **6**

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

(b) Evaluate the impact of ONE technological development in the agricultural industry in terms of both economic and social factors. **12**

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