



PLANT PRODUCTION SYSTEMS

ATAR course examination 2021

Marking key

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

Section One: Multiple-choice

20% (20 Marks)

Question	Answer
1	c
2	b
3	b
4	d
5	d
6	a
7	c
8	a
9	b
10	a
11	b
12	c
13	a
14	d
15	c
16	d
17	b
18	a
19	c
20	b

Section Two: Short answer

50% (96 Marks)

Question 21

(18 marks)

- (a) (i) State which product of photosynthesis is being observed when counting bubbles. (1 mark)

Description	Marks
States Oxygen	1
Total	1

- (ii) Propose an hypothesis relevant to the data in the table below. (2 marks)

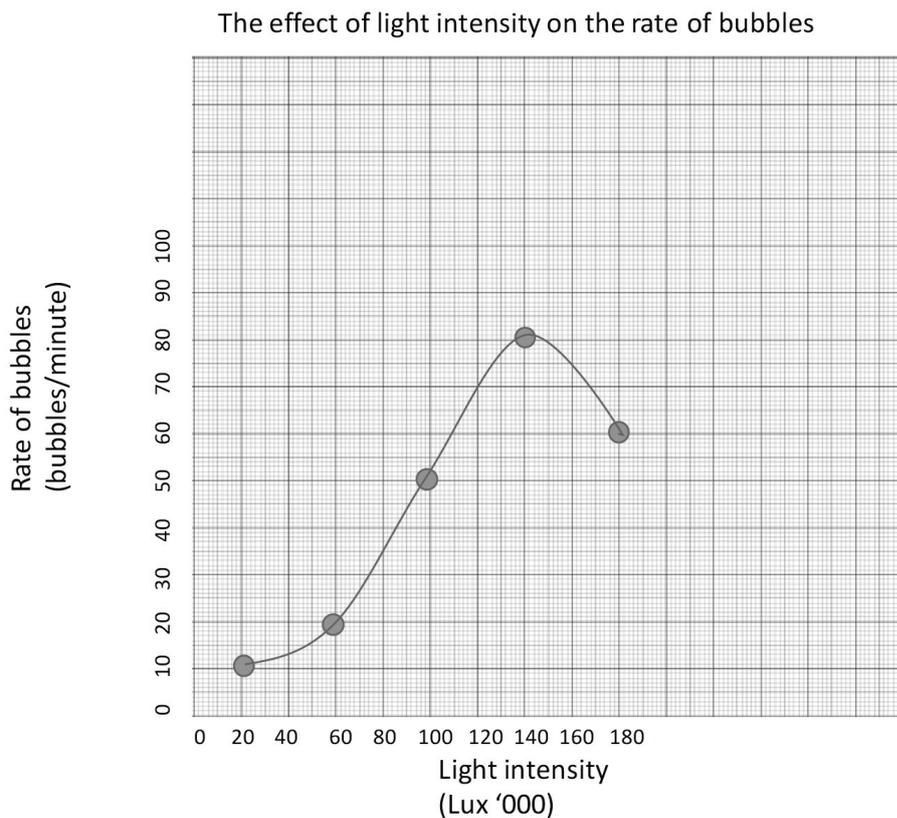
Description	Marks
Proposes an hypothesis giving the relationship between the dependent and independent variables	2
Proposes hypothesis using either the dependent or independent variable	1
Total	2
Answers could include: <ul style="list-style-type: none"> • if the light intensity increases, there will be an increase in the release of oxygen/photosynthesis • photosynthesis will increase with increasing light intensity until it reaches a maximum. 	
Accept other relevant answers.	

Question 21 (continued)

(iii) Using the table on page 8, graph the data on the grid below. (5 marks)

Description	Marks
Accurate relevant title	1
Data is graphed as a continuous line graph	1
Data points are accurate	1
X axis correctly scaled with numbers placed correctly and named with units	1
Y axis correctly scaled with numbers placed correctly and named with units	1
Total	5

Answer could include:



(iv) Draw a conclusion from the graphed data in part (a)(iii). (2 marks)

Description	Marks
Draws a relevant conclusion about the graphed data	2
States a relevant observation about the graphed data	1
Total	2

Answers could include:

- as the light intensity increased, the rate of bubbles increased up to 140 000 lux, it then decreased, thus peak photosynthesis takes place around a light intensity of 140 000 lux.

Accept other relevant answers.

- (b) Complete the table below by writing **increase** or **decrease** in the description of the effect of environmental conditions on the rate of transpiration. (4 marks)

Description		Marks
Environmental conditions		
High relative humidity	Decrease	1
Warmer air	Increase	1
Low soil water	Decrease	1
Windy conditions	Increase	1
Total		4

- (c) Using the terms 'absorbed' and 'translocated', describe how nutrients and sugars are transported by plants. (4 marks)

Description	Marks
Describes how nutrients and sugars are transported by plants accurately using the terms 'absorbed' and 'translocated'	4
Describes how nutrients and sugars are transported by plants, using the terms 'absorbed' and 'translocated'	3
Outlines how nutrients and sugars are transported by plants, using terms 'absorbed' and 'translocated'	2
Makes a relevant statement about nutrients and sugars	1
Total	4
<p>Sample answer: Nutrients are absorbed by roots from the soil in solution and are transported throughout the plant via transpiration in the xylem and used in the process of photosynthesis or for other metabolic processes or building of tissues. The soluble products of photosynthesis (sugars) are then translocated from the leaves to other parts of the plant by the phloem.</p>	
Accept other relevant answers.	

Question 22

(14 marks)

- (a) Describe the role of plant hormones in plant physiology. (3 marks)

Description	Marks
Describes the role coordinating plant growth and development using their concentration level to trigger a response	3
Outlines the role mentioning plant growth and development	2
States a relevant fact about the role of plant hormones	1
Total	3
Answers could also include:	
<ul style="list-style-type: none"> have a role in the coordination of plant growth and development triggering a response due to their concentration. 	
Accept other relevant answers.	

- (b) (i) Complete the table below. (8 marks)

Description			Marks
Stage of growth	A plant hormone used at this stage of growth	An example of the use of this hormone at this stage of growth	
Germination	Gibberellic acid	Breaks dormancy of seeds	1–2
Growth	Auxin	Use on cuttings to promote root growth	1–2
Flowering	Cytokinin	Keeps cut flowers fresher for longer	1–2
Fruit ripening	Ethylene	Bananas can be picked green, transported without bruising and then ripened with ethylene gas	1–2
Total			8
Accept other relevant answers.			

- (ii) Identify a common plant hormone that can be used as a selective weed killer. (1 mark)

Description	Marks
Identifies a common plant hormone, e.g. Auxin	1
Total	1
Accept other relevant answers.	

- (iii) Outline the reason why a plant hormone weed killer can be selective. (2 marks)

Description	Marks
Outlines the reason a plant hormone weed killer can be selective	2
Makes a relevant statement about a plant hormone weed killer	1
Total	2
Answers could also include:	
<ul style="list-style-type: none"> different plants have different sized/shaped leaves that absorb the weed killer at different rates. Large flat leaves absorb more of the weed killer due to their larger surface area. 	
Accept other relevant answers.	

Question 23

(14 marks)

- (a) State an impact of a pest on the financial return for a crop. (1 mark)

Description	Marks
States a relevant fact about an effect on the financial return	1
Total	1
Answers could include: <ul style="list-style-type: none"> • loss of income from crop downgraded due to poor quality • loss of income due to lower yields caused by the pest • lower return due to the costs of controlling the pest. Accept other relevant answers.	

- (b) List the **four** basic steps in developing a pest-resistant variety by using crossbreeding. (4 marks)

Description	Marks
Collect and select varieties that between them have the desired characteristics	1
Cross the collected varieties to combine the desired characteristics under controlled conditions	1
Grow and select the offspring that have the desired characteristics	1
Evaluate the selected offspring for the desired characteristic under field conditions	1
Total	4
Accept other relevant answers.	

- (c) Outline a key advantage genetically-modified organisms (GMOs) have over crossbred varieties in a plant breeding program. (2 marks)

Description	Marks
Outlines a relevant advantage	2
States a relevant advantage	1
Total	2
Answers could include: <ul style="list-style-type: none"> crossbreeding is time consuming, taking up to 10-15 years to produce the desired variety • GMO identifies the desired gene to improve crop production and inserts that DNA into the desired variety in a much shorter time frame • crossbreeding can create huge variation. GMO modification can be much more targeted. Accept other relevant answers.	

Question 23 (continued)

- (d) Identify a genetically-modified organism (GMO) crop and evaluate the aspects of the 'triple bottom line' that a producer needs to consider when choosing to grow a GMO crop instead of a crossbred variety. (7 marks)

Description	Marks
Identifies a relevant GMO crop	1
Subtotal	1
For each part of the triple bottom line framework (3 x 2 marks)	
Evaluates the effect of using GMO instead of a traditional variety by applying economic/environmental/social framework	2
Makes a relevant statement about the effect of using GMO instead of a traditional variety by applying economic/environmental/social framework	1
Subtotal	6
Total	7
<p>Answers could include:</p> <ul style="list-style-type: none"> • Relevant crops: <ul style="list-style-type: none"> ◦ Roundup ready canola ◦ BT cotton ◦ GM safflower ◦ carnations – delayed senescence <p>Issues can be positive or negative:</p> <ul style="list-style-type: none"> • economic – higher income due to higher yields, more uniform product, lower production costs, higher seed cost, need to purchase every year, export market restrictions • environmental – less use of pesticides that can become residual, crossbreeding that will develop into a weed that is difficult to control, overuse of a single herbicide, e.g. glyphosate sprayed in Round-up ready canola can lead to the development of resistance • social – concerns over food safety, incorrect labelling, cross-farm contamination where farmers choose the type of crop they want to produce, e.g. organic status farmers that cannot afford to have any contamination from GM crops. 	
Accept other relevant answers.	

Question 24

(17 marks)

- (a) (i) Explain the information presented in the graph. (3 marks)

Description	Marks
Explains the relationship between the presence and absence of natural predators using specific data points from the graph	3
Outlines the increases and decreases of aphids in the presence of or absence of natural predators	2
Makes a relevant statement about the graph	1
Total	3
Answers could include: <ul style="list-style-type: none"> The number of aphids increased over time until 19 May in the presence and absence of the natural enemies. However, the natural enemies limited the increase to under five aphids/tiller while in their absence the aphids rapidly increase after 28 April, and reached nearly 20 aphids/tiller by 19 May before beginning to decline. 	
Accept other relevant answers.	

- (ii) Outline the economic implications for production from the data in the graph above. (2 marks)

Description	Marks
Outlines the implications to production shown in the graph	2
Makes a relevant statement about the implications to production shown in the graph	1
Total	2
Answers could include: <ul style="list-style-type: none"> production will be significantly reduced if the aphids are allowed to go uncontrolled thus reducing income from yield the presence of a natural enemy will keep damage to a low level and minimise or remove the need to use a pesticide thus reducing input costs. 	
Accept other relevant answers.	

- (b) Discuss
- two**
- possible sources of experimental error for the data graphed on page 14. (6 marks)

Description	Marks
For each of the errors	
Discusses a possible experimental error in the collection of data	3
Outlines a possible experimental error in the collection of data	2
Makes a relevant statement about experimental error in the collection of data	1
Subtotal	3
Total	6
Answers could include: <ul style="list-style-type: none"> different people counted the aphids in the present and absent natural enemy treatments no replication of treatments could mean that the results may reflect variation in other factors (e.g. crop nutrition) and not be due to the impact of the natural enemy, particularly if the two treatments were not on the one farm the wheat crops were not comparable, i.e. not sown on the same day, not at the same stage of growth, not the same variety. 	
Accept other relevant answers.	

Question 24 (continued)

- (c) Recommend on-farm management strategies that should be adopted to restrict the wider spread of Russian wheat aphid in Western Australia. (4 marks)

Description	Marks
Recommends on-farm strategies that limit the wider spread including on-going monitoring of crops	4
Describes on-farm strategies that limit the wider spread including on-going monitoring of crops	3
Outlines on-farm strategies that limit the wider spread	2
Makes a relevant statement about an on-farm strategy to restrict the spread	1
Total	4
Answers could include: Monitoring crops and reporting presence or absence of the aphid using the MyPestGuide reporter from germination through to maturity. <ul style="list-style-type: none"> • Practice on-farm biosecurity: <ul style="list-style-type: none"> ◦ avoid driving vehicles through crops, wash down machinery thoroughly ◦ limit the movement of people and equipment near any suspect crops ◦ wash hands, brush down clothes and boots between crop inspections • treatment of seed with a dressing before seeding for early control in affected areas • encourage/introduce the natural predator population • use an pesticide where aphid numbers are increasing rapidly. Accept other relevant answers.	

- (d) Outline a critical reason for controlling Russian wheat aphid to maintain Australia's global competitiveness. (2 marks)

Description	Marks
Outlines a reason for controlling Russian wheat aphid that is related to Australia's global competitiveness	2
States a relevant reason for controlling Russian wheat aphid that is related to Australia's global competitiveness	1
Total	2
Answers could include: <ul style="list-style-type: none"> • when feeding, the Russian wheat aphid can retard the growth of the plant, thus affecting yields and Australia's capacity to maintain export markets with limited production and quality of grain • a heavy infestation will kill wheat plants, decimating yields and Australia's capacity to maintain its export markets. Note: The wheat grain is NOT a host so it cannot contaminate a consignment. Accept other relevant answers	

Question 25

(18 marks)

- (a) (i) Summarise the
- most**
- important points from the graph above. (3 marks)

Description	Marks
Summarises the most important points on the graph that highlight the rate of increase in resistant populations to various chemicals	3
Outlines the relevant points on the graph that highlight the rate of increase in resistant populations to various chemicals	2
Makes a relevant statement about the graph and increase in resistant populations	1
Total	3
Answers could include:	
<ul style="list-style-type: none"> development of resistance between herbicides varies greatly between products resistance is generally increasing over time half of these products should not be used. 	
Accept other relevant answers.	

- (ii) Outline the benefit to a producer of herbicides having different modes of action. (2 marks)

Description	Marks
Outlines the benefit of different modes of action of herbicides	2
Makes a relevant statement about different modes of action of herbicides	1
Total	2
Answers could include:	
<ul style="list-style-type: none"> Allows producer to rotate herbicides by mode of action that enables producer to minimise, avoid or slow development of herbicide-resistant weeds. 	
Accept other relevant answers.	

- (iii) Outline how herbicide resistance develops in a weed population. (2 marks)

Description	Marks
Outlines how herbicide resistance develops in weeds	2
Makes a relevant statement about how herbicide resistance develops in weeds	1
Total	2
Answers could include:	
<ul style="list-style-type: none"> plants that are genetically resistant to a particular herbicide, survive after its application to set seed and pass their resistance to their offspring. Thus the proportion of the total population that is resistant increases it is the inherited ability of an individual plant to survive a herbicide application that would kill a normal population of weeds. There is always variation in a population, with some individuals able to survive, set seed and dominate the next germination the continued use of a herbicide with the same mode of action poor calibration/spraying technique that delivers a rate that is insufficient to kill the weeds. 	
Accept other relevant answers.	

Question 25 (continued)

- (b) Using a plant production system you are familiar with, describe **two** short and **two** long-term strategies you could use to slow the development of herbicide resistance.

(8 marks)

Description	Marks
For each short-term strategy	
Describes a strategy	2
States a strategy	1
Subtotal	4
For each long-term strategy	
Describes a strategy	2
States a strategy	1
Subtotal	4
Total	8
<p>Answers could include: The familiar plant production system could be as broad as pasture or as narrow as wheat provided the student refers to it in the answer.</p> <p>Short-term:</p> <ul style="list-style-type: none"> • use the label recommended rates, application time and plant growth stage • reduce seedbank by spray topping, chaff cart, Harrington Seed Destructor, grazing • keep accurate spray records for each paddock and rotate herbicides according to modes of action • only use graded, clean seed. <p>Long-term:</p> <ul style="list-style-type: none"> • carry out resistance testing to identify potential resistance problems • reduce reliance on herbicides by routinely utilising other strategies such as slashing, grazing, topping to reduce the seed bank • selectively breed crops that are more vigorous and can out-compete weeds • reduce weed contamination on boundaries by establishing buffers • implement a diverse cropping rotation to enable a diversity of, and rotation of, herbicides by mode of action. <p>Accept other relevant answers.</p>	

- (c) Evaluate a new technology that will minimise the development of herbicide resistance. (3 marks)

Description	Marks
Evaluates a new technology that minimises herbicide resistance	3
Describes how a new technology can minimise herbicide resistance	2
States a relevant fact about a new technology that minimises herbicide resistance	1
Total	3
<p>Answers could include:</p> <ul style="list-style-type: none"> • chaff carts – collect chaff from combine harvester during harvesting, which includes weed seeds, which can be stockpiled for treatment, e.g. burning. Resistance seeds are not returned to the seed bank and thus the population of resistant weeds does not increase over time. • Harrington Weed Seed Destructor – smashes weed seeds as they pass out of the harvester. Resistance seeds are not returned to the seed bank and thus the population of resistant weeds does not increase over time. • spraybots that target individual weeds using infra-red cameras, lasers and mechanical arms to remove weeds. No herbicides are applied and hence resistance does not develop. • weedseeker – targets individual weeds, not bare ground. Saves on herbicide costs. Reduced use or carefully calibrated use of herbicides reduces rate of resistance developing. 	
Accept other relevant answers.	

Question 26

(15 marks)

- (a) (i) From the table above, select a cultivar that would be **best** suited to a shorter growing season. (1 mark)

Description	Marks
Selects Gamma	1
Total	1

- (ii) Outline the reasons for your selection in part (a)(i). (2 marks)

Description	Marks
Outlines the reason for the choice of variety as it relates to climate change (higher temperature, lower rainfall, increasing intense weather events)	2
States a relevant fact about the choice of variety as it relates to climate change	1
Total	2
Answers could include: Reasons include: <ul style="list-style-type: none"> Gamma is a better variety for an early finish – unreliable winter rainfall as a consequence of climate change and with a reasonable yield Note: Accept Alpha in part (a)(i) if appropriate justifications are provided in part (a)(ii) Accept other relevant answers.	

- (b) Apart from using an improved cultivar, propose **two** adaptations to a plant production system in response to climate change. (6 marks)

Description	Marks
For each adaptation	
Proposes an adaptation that could meet the changing circumstances of climate change	3
Outlines an adaptation that could meet the changing circumstances of climate change	2
Makes a relevant statement about an adaptation that could meet the changing circumstances of climate change	1
Subtotal	3
Total	6
Answers could include: Adaptions: <ul style="list-style-type: none"> stubble retention to conserve moisture and hold the soil together use inputs more efficiently, such as variable rate technology and split applications of fertiliser weed seeker technology to take out summer weeds and conserve moisture dry seeding to take advantage of the opening rains for germination of crops grazing crops to take profits early in the season as a hedge against no yield in a dry finish deep sowing using long coleoptile cultivars to allow germination in deeper soil water varying sowing time or other tactics to reduce the chances of frost at flowering. Accept other relevant answers.	

- (c) (i) State which cultivar in the table on page 19 is most likely to have the **greatest** benefit for the producer's financial return in a good season. (1 mark)

Description	Marks
States Beta	1
Total	1

- (ii) Outline a reason for your selection in part (c)(i). (2 marks)

Description	Marks
Late maturity of Beta allows use of all rainfall to maximise yield whilst maintaining a moderate oil potential	2
Makes a relevant statement about the higher yield returning a higher income	1
Total	2
Accept other relevant answers.	

- (iii) For a new cultivar that has been harvested, evaluate **one** on-farm practice used to meet the grain quality requirements. (3 marks)

Description	Marks
Evaluates a quality requirement of a newly grown cultivar	3
Describes a quality requirement of a newly grown cultivar	2
Makes a relevant statement about a quality requirement of a newly grown cultivar	1
Total	3
Answers could also include: Quality requirement: 1. keep varieties segregated once harvested to ensure pure seed although may involve extra storage costs 2. minimise the risk of contamination in handling equipment by cleaning augers, silos, chaser bins, headers, trucks when changing paddocks to a different variety. This will cost more because of time spent cleaning, and risks of slowing harvest operations 3. choose harvest time to manage grain moisture levels, and dry if required 4. prior to storage, monitor for insect activity, treat and record where required.	
Accept other relevant answers.	

Section Three: Extended answer

30% (40 Marks)

Question 27

(20 marks)

- (a) Would your nominated plant production enterprise be suitable for production in paddock 38? Justify your decision based on the nutrient status shown in the soil test report on page 22. (3 marks)

Description	Marks
Justifies the decision by referring to three nutrients in the soil test results	3
Outlines the decision by referring to at least two nutrients in the soil test results	2
Makes a relevant statement about the decision by referring to the soil test results	1
Total	3
Answers could include: <ul style="list-style-type: none"> • pasture – high N will benefit the grasses but P and K will need to be applied to ensure a high seedling establishment • crop – high N will benefit a cereal or canola crop but P and K will need to be applied at seeding to ensure there is a high seedling establishment • crop – a major benefit of legume based crops is N-fixation which will not utilise the N in the soil. If a legume crop is the nominated plant production enterprise more emphasis needs to be placed on supplying P and K. 	

- (b) (i) Assess the soil test results on page 22 and recommend which nutrients would need to be provided to optimise production in your plant production enterprise. (3 marks)

Description	Marks
Recommends the application of P on the North and East sites and K over the whole paddock	3
Outlines the need for either P or K	2
Makes a relevant comment about the need for fertiliser to be applied	1
Total	3
Accept other relevant answers.	

- (ii) Describe the plant nutrition program, including the nutrients recommended in part (b)(i), to maximise production. (3 marks)

Description	Marks
Describes the timing and application method of the plant nutrition program, including tissue testing to provide an accurate assessment of nutrient uptake and further applications to maximise production	3
Outlines the plant nutrition program to maximise plant production, including timing and application method	2
Makes a relevant statement about when to apply fertiliser to maximise plant production	1
Total	3
Answers could include: <ul style="list-style-type: none"> • P and K need to be available at germination – in a crop they would be banded with the seed. In a pasture they would be top-dressed prior to the break of the season 	

<ul style="list-style-type: none"> • a plant tissue test will indicate any further applications of P and K and how much N should be applied to maximise production • top-dressing N or applying Flexi-N (liquid) will be determined by the soil conditions and forecast rain.
Accept other relevant answers.

(iii) Outline how the soil test results from the table on page 22 might influence your future management of the paddock. (2 marks)

Description	Marks
Outlines how the results might influence future plantings	2
Makes a relevant statement about the results and how they might influence future plantings	1
Total	2
Answers could include: pH is dropping, becoming more acidic, will affect the choice of crop type in the future, e.g. grow barley not wheat; sow serradella not lucerne or sub-clover	
<ul style="list-style-type: none"> • organic carbon is getting low in South and West sites. Management of crop residues needs to be monitored to raise their levels • would wait until N is lower until planting a pulse or pasture legume • would wait until K is restored until planting a hay crop. 	
Accept other relevant answers.	

(c) Assume you have purchased the farm. In the following year, you decide to apply lime to adjust the soil pH. There are two products available. Complete the budget below and state the **most** cost-effective product. (7 marks)

Description	Marks
A = \$32	1
B = \$48	1
C = \$160	1
D = \$2	1
E = \$3	1
F = \$155	1
Subtotal	6
Most cost-effective product	
States calcium pellet	1
Subtotal	1
Total	7
Note: Award follow-through marks for identification of most effective product.	

(d) Outline how fertilisers should be applied to mitigate environmental impacts. (2 marks)

Description	Marks
Outlines how this product should be applied to minimise environmental impacts	2
Makes a relevant statement about applying the product to minimise environmental impacts	1
Total	2
Answers could include: <ul style="list-style-type: none"> • when top-dressing stay clear from natural waterways, paddock catchments and avoid spreading before heavy rain to avoid fertiliser being washed away. 	
Accept other relevant answers.	

Question 28

(20 marks)

- (a) Describe the known impacts of climate change on plant production systems in Western Australia. (8 marks)

Description	Marks
Describes a range of impacts of climate change on plant production systems	7–8
Outlines some impacts of climate change on plant production systems	5–6
Makes a relevant statement about the known impacts of climate change on plant production	3–4
Makes a relevant statement about one known impact on plant production	1–2
Total	8
<p>Answers could include: Impacts include:</p> <ul style="list-style-type: none"> • warmer, drier conditions will be more extreme in marginal areas for plant production systems • warmer temperatures could improve yields from a reduction in frost incidence and waterlogging in traditionally higher rainfall areas • increased intensity and duration of heatwaves, reducing yields at critical times such as flowering • rainfall that can recharge soil moisture will be less prevalent and later into winter • drier, hotter conditions increase the risk of fire due to drier fuel • increased incidence of summer cyclone-related rainfall events • increased risk of frost due to changed meteorological condition • decreased risk of development of dryland salinity • change in the prevalence of pests and diseases including increase risk of ones that are favoured by plants being stressed, e.g. water stress. 	
Accept other relevant answers.	

- (b) For **one** of the impacts described in part (a), assess the risk of crop failure using the matrix below by applying it to a plant production system you are familiar with and propose how to manage that risk. (12 marks)

Description	Marks
Assesses the risk against probability and consequence	2
States a relevant impact and the risk of crop failure	1
Subtotal	2
Risk Management	
Proposes risk management strategies	9–10
Explains risk management strategies	7–8
Describes risk management strategies	5–6
Outlines risk management strategies	3–4
States a relevant risk management strategy	1–2
Subtotal	10
Total	12
<p>Answers could include:</p> <ul style="list-style-type: none"> • crop species and variety selection – select crops with a higher tolerance for dry conditions, heat stress and capacity to maximise water use efficiency or have a shorter growing season or long coleoptiles suitable for deep sowing • opportunistically sow summer cover crops to take advantage of summer rain • rotate legumes to provide mineral nitrogen and lower reliance on nitrogen fertilisers • early (dry) sowing to take advantage of opening rains, crops produce more biomass. Also reduces exposure to heat stress at end of growing season • use farming practices that minimise soil disturbance and reduce evaporation such as minimum tillage/zero till, controlled traffic and variable rate technology to maximise the use of herbicides/fertilisers • adopt a strategic cropping strategy – where there is no opportunity to plant, don't, or have the flexibility to change the program as the season unfolds • split fertiliser applications to enable the benefit from a second application to be assessed as the season progresses • grazing crops to take profits early in the season. 	
Accept other relevant answers.	

Question 29

(20 marks)

- (a) State an example of a plant product system and its major export market. Discuss the reasons Australia has a comparative advantage in that plant product system. (10 marks)

Description	Marks
States a relevant plant product and its major market	2
States a relevant plant product OR major market	1
Subtotal	2
Advantages	
Discusses reasons for Australia's comparative advantage for the example given	7–8
Describes reasons for Australia's comparative advantage for the example given	5–6
Outlines reasons for Australia's comparative advantage for the example given	3–4
Makes a relevant statement referring to a reason for Australia's comparative advantage for the example given	1–2
Subtotal	8
Total	10
<p>Answers could also include:</p> <ul style="list-style-type: none"> product/market – wheat/Japan, canola/Germany, barley/China, pulses/Netherlands, vegetables/UAE, fruit/Singapore <p>Comparative advantages:</p> <ul style="list-style-type: none"> land and irrigation resources available to expand production (Ord River) diverse geographical and climatic conditions allowing production of a wide range of products modern infrastructure and sophisticated supply chains access to the latest innovations through vibrant national and international science and innovation partnerships a stable, well-regulated economy with a skilled and productive labour force a beneficial geographic location that is in the same time zone as many of our main export markets a production base that is geographically isolated from the rest of the world and protected by world-class biosecurity practices, ensuring our produce is relatively free from exotic pests and diseases a well-managed and protected environment that uses high-quality, traceable systems and certification to ensure WA maintains its advantage as a reliable producer of clean, safe and premium food. 	
Accept other relevant answers.	

- (b) Explain **three** strategies Australian plant producers can use to satisfy the short-term need for production against the long-term improvement of resources, and still remain sustainable. (10 marks)

Description	Marks
Explains three strategies that satisfy a short-term need for production and cater for long-term improvement of resources while remaining sustainable	9–10
Describes two or three strategies that satisfy a short-term need for production and cater for long-term improvement of resources while remaining sustainable	7–8
Outlines two or three strategies that includes a short-term need for production and cater for long-term improvement of resources while remaining sustainable	5–6
Outlines a strategy that includes a short-term need for production and caters for long-term improvement of resources while remaining sustainable	3–4
Makes a relevant statement about a strategy that includes a short-term need for production and/or caters for long-term improvement of resources	1–2
Total	10
<p>Answers could also include: The resources are soil, water and native vegetation.</p> <p>Short-term strategies include:</p> <ul style="list-style-type: none"> • changing crop establishment practices to incorporate minimum tillage/zero tillage to minimise soil disturbance • retain stubble and incorporate to increase carbon levels, reduce carbon loss through burning • rotational cropping that includes a legume to reduce the use of nitrogen fertilisers in following crops or green manuring to boost soil fertility • select varieties based on resilience rather than yield so that there is less reliance on pesticides/lower input costs • utilise water harvesting techniques when sowing crops to maximise water availability • use water where it falls by installing contour/absorption banks, water repellence treatments, clay spreading rather than allowing it to create run-off which potentially can create erosion and water eutrophication issues • fence out native vegetation and control invasive weeds and pests • create buffer zones to reduce spray/fertiliser drift into native vegetation areas • re-fence, replant areas of low productivity back to the native flora, creating green corridors for native fauna to move around the farm. <p>Long-term resource improvement include:</p> <ul style="list-style-type: none"> • a stable, fertile, healthy soil that builds and recycles organic matter, maintains an active soil microbe population and retains nutrients • a clean, healthy water source that has the capacity to filter out nutrients on its banks (riparian area) and support a native flora and fauna population • native vegetation that is weed and pest free, self-sustaining and able to support native fauna • carbon neutral farming systems. <p>Accept other relevant answers.</p>	

ACKNOWLEDGEMENTS

- Question 25(a)(iii)** Dot point 2 from: Department of Primary Industries and Regional Development, Agriculture and Food. (2021). *Herbicide resistance*. Retrieved September, 2021, from <https://www.agric.wa.gov.au/grains-research-development/herbicide-resistance#:~:text=Herbicide%20resistance%20is%20the%20inherited,population%20of%20the%20same%20species>.
- Question 29(a)** Dot points 2–9 from: Department of Primary Industries and Regional Development. (2018). *Western Australia's agrifood, fibre, fisheries, forestry industries 2018*. Retrieved September, 2021, from <https://www.agric.wa.gov.au/sites/gateway/files/Western%20Australia%27s%20Agrifood%2C%20Fibre%2C%20Fisheries%20and%20Forestry%20I ndustries%202018%20-%20Word.docx>

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