

# HURLSTONE AGRICULTURAL HIGH SCHOOL



## Trial Higher School Certificate Examination 2011

### AGRICULTURE

#### General Instructions:

- \* Reading time – 5 minutes
- \* Working time – 3 hours
- \* Write using a black or blue pen
- \* Draw diagrams in pencil
- \* Board approved calculators may be used
- \* Write your student number at the top of each page

Examiners – Mr. R. M<sup>c</sup>Gregor,  
Ms. E. Blake, Mr. R. Schippers

**Total marks – 100 marks**

#### SECTION I

##### Part A – 20 marks

20 Multiple Choice questions  
*Answer these questions on the  
Multiple Choice answer sheet*  
Allow about 30 minutes for these  
questions  
Questions 1 – 20

##### Part B – 60 marks

Questions 21 – 26  
Allow about 100 minutes for these  
questions

#### SECTION II

##### Electives – 20 marks

Questions 27 – 29  
Choose ONE elective.  
*Answer your elective question in  
writing booklets*  
Allow about 50 minutes for this  
question

## SECTION I

Part A – 20 marks

20 Multiple Choice questions.

Allow about 30 minutes for this part.

Answer ALL questions on the Multiple Choice answer sheet.

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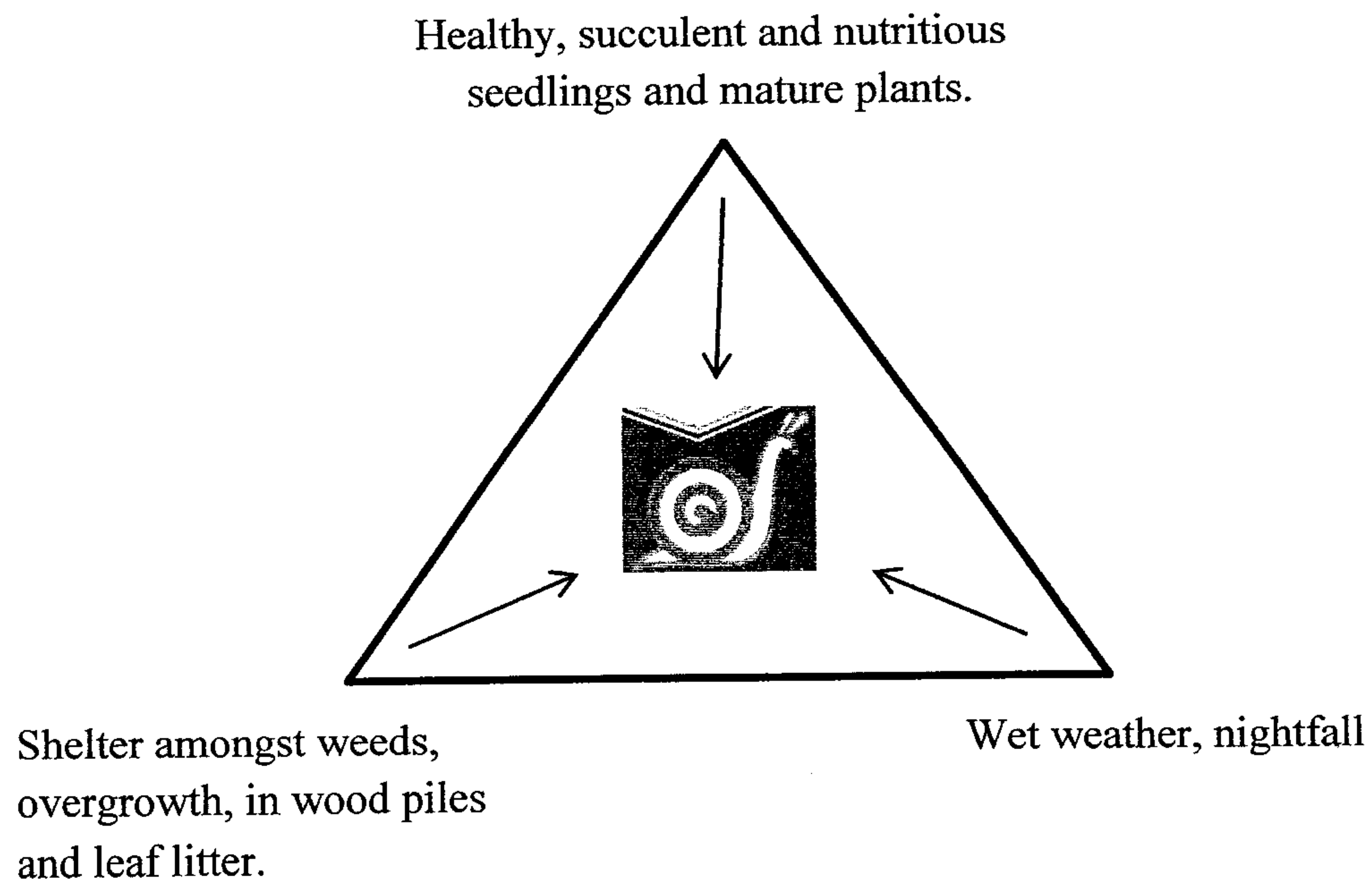
### Question 1.

Allelopathy is an example of plant competition within a crop or pasture and it is best described as –

- (A) crop plants competing with each other for sunlight, water and nutrients.
- (B) crop plants creating an ideal micro-climate for a fungal disease to take hold.
- (C) weeds sheltering and feeding an insect pest that then moves onto a crop.
- (D) weeds releasing a chemical into the soil to kill surrounding plants that may compete.

### Question 2.

The following represents a pest triangle for garden snails –



The pest triangle does not show –

- (A) the most susceptible host, sources of the pest and the ideal environment for the pest.
- (B) the variety of practices that should be used as part of an Integrated Pest Management program.
- (C) the complex interactions that need to come together for the pest to become a problem.
- (D) the understanding that is needed to devise new strategies that could be used in an IPM program.



### Question 3.

Read carefully through the following pesticide label –



For control of tomato grub and leafminer in tomatoes and capsicums, *Heliothis* caterpillars, tobacco stemborer and leafminer in tobacco and *Heliothis* caterpillars in cotton as specified in the directions for use table.

#### General Instructions

**Mixing:** Add the required quantity of Helothion EC to water in the spray vat while stirring or with agitators in motion. Helothion EC may be applied through ground rigs or aircraft.

**Resistance note:** The effectiveness of this product may be reduced or nullified as a result of pests developing a tolerance or resistance to the product. If unacceptable control occurs immediately contact your Bayer representative. This product should not be used where the user suspects that a tolerant or resistant strain is present.

#### Compatibility

Helothion EC is compatible with most commonly used fungicides on tomatoes, capsicums and tobacco including Antracol<sup>®</sup>, and is also compatible with Bayleton<sup>®</sup>, Def<sup>®</sup>, Folidol<sup>®</sup> M500, Metasystox<sup>®</sup> (i).

The compatibilities given are based on world wide experience and are considered correct. However as changes in climatic conditions can alter the sensitivity of plants to mixtures of sprays, we accept no responsibility for the behaviour of such mixtures.

#### Protection of Livestock

Dangerous to bees. Do NOT spray any plants in flower while bees are foraging.

#### Protection of Wildlife, Fish, Crustacea and Environment

Do NOT contaminate ponds, waterways and drains with the chemical or used container.

#### Storage and Disposal

Store in the closed, original container in a well ventilated area, as cool as possible. Do not store for prolonged periods in direct sunlight. Triple rinse empty container. Puncture top, bottom and sides of empty container, then crush and bury in an approved landfill, or bury under at least 500 mm of soil in a non-crop, non-pasture area away from water sources or homes. Do not burn empty container or product.

#### Safety Directions

Product and spray are poisonous if absorbed by skin contact, inhaled or swallowed. Repeated minor exposure may have a cumulative poisoning effect. Avoid contact with eyes and skin. Do not inhale spray mist. When opening the container, preparing spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist and washable hat, elbow-length PVC gloves and face shield. If product on skin, immediately wash area with soap and water. After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water. After each day's use, wash gloves, face shield and contaminated clothing. Obtain an emergency supply of atropine tablets 0.6 mg.

#### First Aid

If poisoning occurs, contact a doctor or Poisons Information Centre. If **swallowed**, induce vomiting preferably using Ipecac Syrup APF and give one atropine tablet every 15 minutes until dryness of the mouth occurs. If **poisoned by skin absorption or through lungs**, remove any contaminated clothing, wash skin thoroughly and give atropine tablets as above. Get to a doctor or hospital quickly.

Choose the incorrect statement from those below –

- (A) On some farms, the targeted insect pests have been developing resistance to this insecticide.
- (B) This insecticide is poisonous or toxic to bees, wildlife, fish, crustaceans and humans.
- (C) When spraying the insecticide the farmer should wear overalls, a hat, gloves and a face shield.
- (D) The insecticide will kill *Heliothis* caterpillars in tobacco, cotton and any vegetable crop.

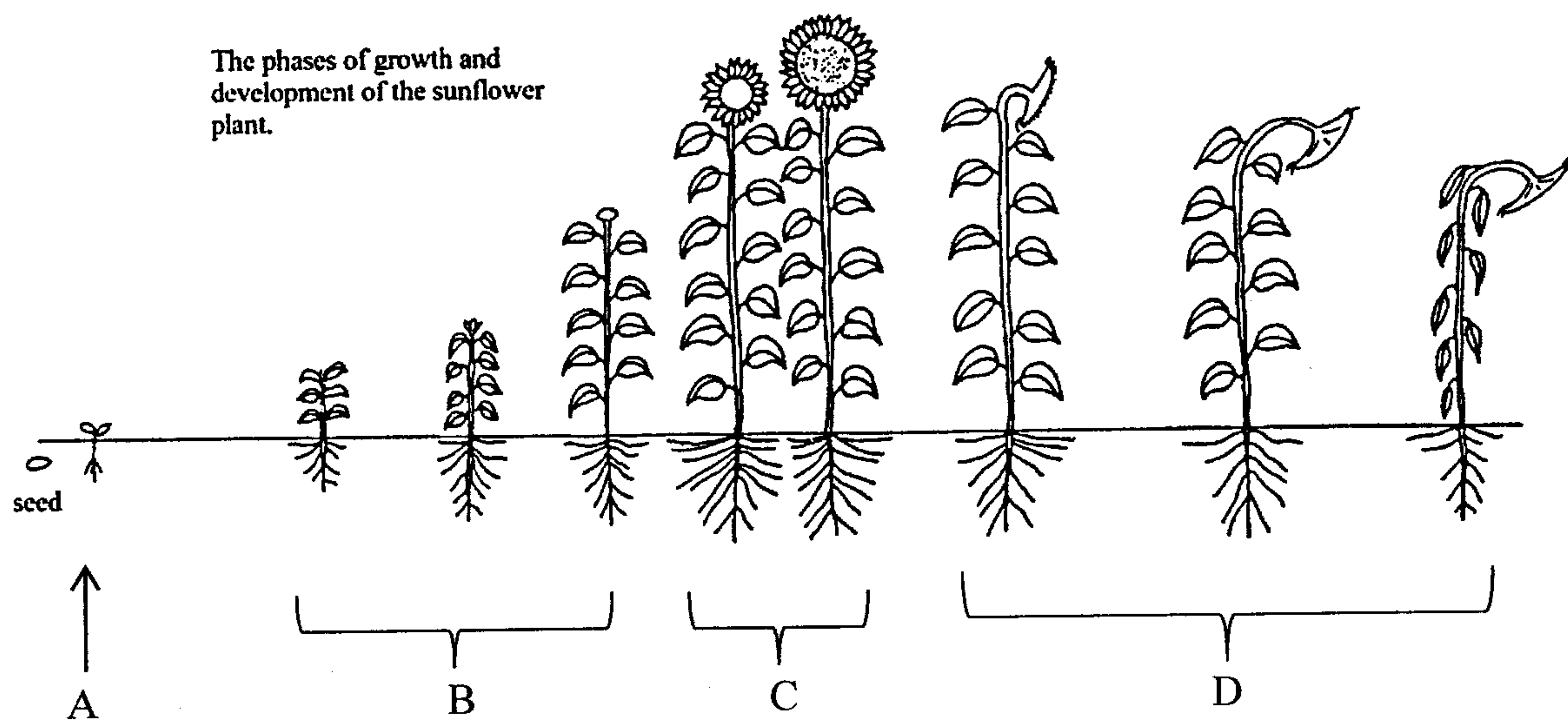
### Question 4.

The plant's naturally occurring hormones have the following roles –

- (A) Auxin controls shoot and root growth and abscisic acid promotes fruit drop.
- (B) Ethylene initiates fruit ripening and gibberellin closes stomates.
- (C) Cytokinin produces cell elongation and auxin produces leaf drop in deciduous trees.
- (D) Abscisic acid promotes cell division and ethylene stimulates leaf growth.

**Question 5.**

The sunflower plant is harvested for the oil content of its seeds



The correct terms for the four phases of growth and development shown by letters A to D are called –

- (A) A – emergence; B – leaf set; C – seed set; D – senescence.
- (B) A – seedling; B – rapid root growth; C – bud and flower set; D – dry off for harvest.
- (C) A – emergence; B – rapid shoot growth; rapid root growth; D – plant death.
- (D) A – seedling; B – vegetative growth; C – reproductive development; D – maturity.

**Question 6.**

The following table shows some features of three soils –

<i>Soil type</i>	<i>Aeration (% of volume)</i>	<i>Readily available water</i>	<i>Readily available nutrients to plant roots</i>	<i>Nutrients leached from root zone</i>
<b>Sandy loam</b>	30	5	5	20
<b>Silty loam</b>	20	15	20	10
<b>Clay loam</b>	10	20	10	5

It can be concluded from the table that –

- (A) The most fertile soil is the silty loam whilst the least fertile is the sandy loam.
- (B) The most fertile soil is the clay loam and the least fertile is the silty loam.
- (C) The most fertile soil is the sandy loam and the least fertile soil is the clay loam.
- (D) The most fertile soil is the clay loam and the least fertile soil is the sandy loam.

**Question 7.**

The ruminant stomach which closely resembles the true monogastric stomach is the –

- (A) abomasum.
- (B) omasum.
- (C) reticulum.
- (D) rumen.



**Question 8.**

Digestible energy is best defined as –

- (A) energy for maintenance and production.
- (B) a measure of the total energy of a food.
- (C) the total energy minus the energy contained in faeces.
- (D) the net energy minus heat energy.

**Question 9.**

Environmental factors that could limit cow or bull fertility include –

- (A) genotype, climate, nutrition, pests and diseases.
- (B) climate, nutrition, management, pests and diseases.
- (C) genotype, climate, management, pests and diseases.
- (D) none of the above.

**Question 10.**

The following are concentrated sources of energy –

- (A) fishmeal, maize, sorghum, oats and wheat.
- (B) maize, sorghum, oats, wheat and barley.
- (C) oaten straw, meatmeal, maize, oats and wheat.
- (D) cellulose, maize, sorghum, oats and wheat.

**Question 11.**

The animal ethics and welfare Code of Practice for sheep includes information such as –

- (A) the need for a nutritionally adequate diet to maintain health.
- (B) protection from climatic extremes, predators and diseases.
- (C) management practices and guidelines for husbandry operations.
- (D) all of the above.

**Question 12.**

An example of how an understanding of an animal's physical and behavioural characteristics can assist in the management of an animal, would be –

- (A) cattle have a narrow field of vision (150°).
- (B) cattle will not detect sudden movements and so they are not startled by them.
- (C) cattle are most comfortable when they are isolated from the mob.
- (D) approach animals calmly from the side whilst pushing them through the handling yards.

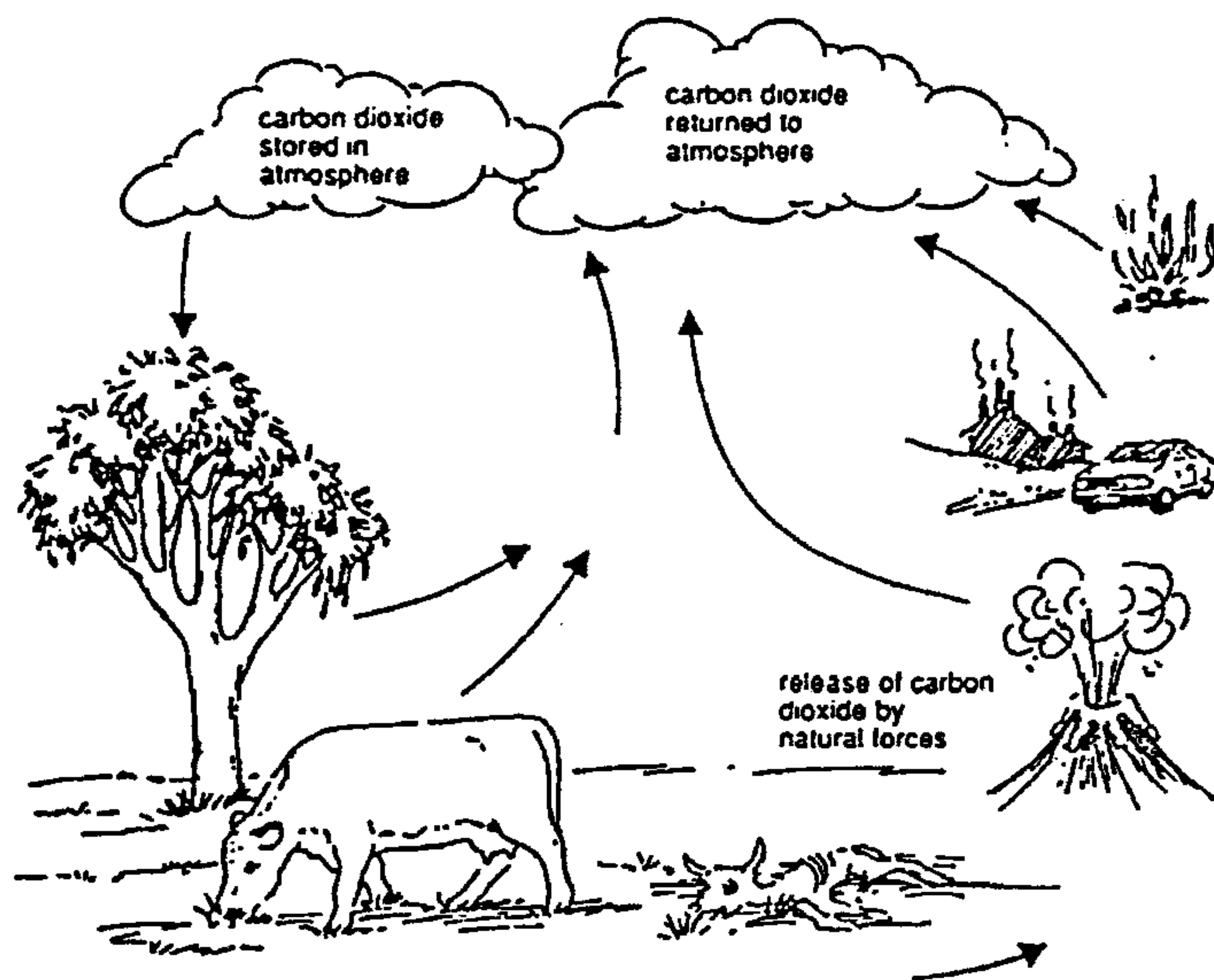
**Question 13.**

The process of photosynthesis in plants is best described as –

- (A) Oxygen + water + solar energy + chlorophyll → carbon dioxide + glucose + water
- (B) Carbon dioxide + water + solar energy + chlorophyll → oxygen + glucose + water
- (C) Oxygen + water + solar energy + chlorophyll → carbon dioxide + readily useable energy + water
- (D) Carbon dioxide + water + solar energy + chlorophyll → oxygen + readily useable energy + water

**Question 14.**

The diagram shows the carbon cycle.



The cycle includes the following –

- (A) Carbon dioxide capture by respiring animals and carbon dioxide release from volcanoes.
- (B) Carbon release through decomposing plants and animals and carbon dioxide capture by clouds.
- (C) Carbon dioxide capture by photosynthesizing plants and carbon release by burning fuels.
- (D) Carbon release by respiring plants and carbon dioxide capture by animal protein synthesis.

**Question 15.**

Sustainable farming includes –

- (A) maintaining the quality of the farm's natural resources and maximising water and nutrient re-cycling.
- (B) maintaining the farm's profitability and ensuring that the farm's animals and plants are healthy.
- (C) minimizing the use of energy and non-renewable resources and maximising short term productivity.
- (D) minimizing the damage to the farm's soils and water resources and maximizing farm profitability through the use of manufactured fertilisers.



**Question 16.**

The sentence that best describes the role of *Rhizobium bacteria* is –

- (A) They form a symbiotic relationship with pasture plants such as kikuyu and ryegrass, where these plants benefit by being supplied with sulphate ions.
- (B) They form a symbiotic relationship with pasture plants such as red and white clover, where these plants benefit by being supplied with phosphate ions.
- (C) They form a symbiotic relationship with crop plants such as wheat and corn, where these plants benefit by being supplied with potassium ions.
- (D) they form a symbiotic relationship with crop plants such as peas and beans, where these plants benefit by being supplied with nitrate ions.

**Question 17.**

The statement that correctly outlines one stage in the nitrogen cycle is –

- (A) Mineralisation is the decomposition of organic matter by soil fungi and bacteria releasing ammonium ions.
- (B) Nitrification is the conversion of nitrite ions to nitrate ions by soil bacteria.
- (C) De-nitrification is the washing away of nitrate ions from the root zone of plants.
- (D) Ammonification is the breakdown of organic matter to nitrite ions by bacteria and fungi.

**Question 18.**

Tomatoes, bananas and pineapples can be artificially ripened through the use of –

- (A) auxin.
- (B) cytokinin.
- (C) gibberellins.
- (D) ethylene.

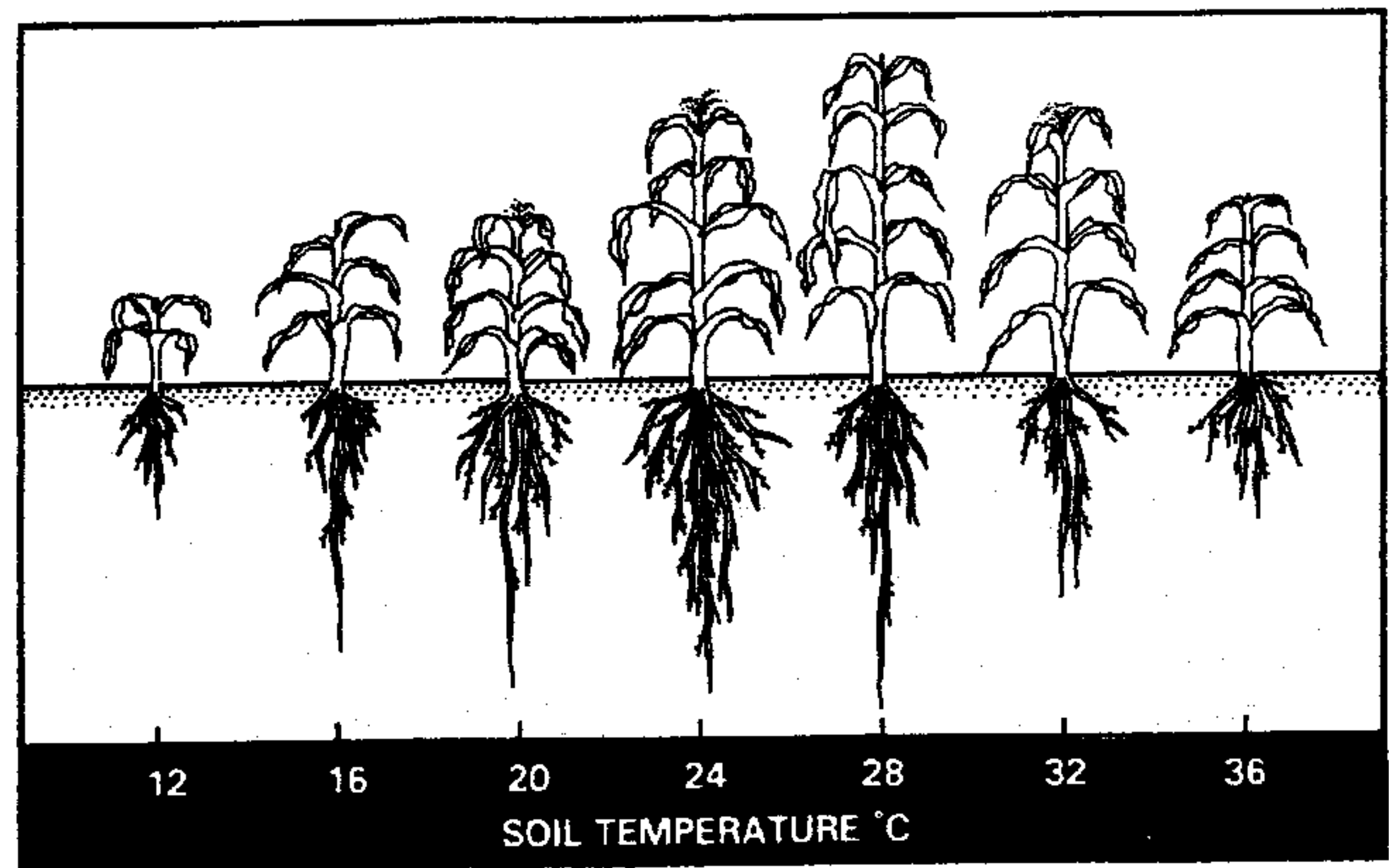
**Question 19.**

If a soil has a high ion exchange capacity, this means that –

- (A) Positively charged clay and organic matter particles loosely hold onto negatively charged ions such as ammonium and calcium which are released into the soil water for uptake by plant roots.
- (B) Positively charged clay and organic matter particles loosely hold onto negatively charged ions such as nitrate and sulphate which are released into the soil water for uptake by plant roots.
- (C) Negatively charged clay and organic matter particles loosely hold onto positively charged ions such as ammonium and calcium which are released into the soil water for uptake by plant roots.
- (D) Negatively charged clay and organic matter particles loosely hold onto positively charged ions such as nitrate and sulphate which are released into the soil water for uptake by plant roots.

**Question 20.**

The diagram shows the impact of soil temperature on plant growth.



To control soil temperatures and so maximize fruit tree growth and production, the farmer ***would not*** –

- (A) Irrigate the fruit trees on very hot days.
- (B) Place a pea straw mulch around each fruit tree.
- (C) Build up soil organic matter levels by regularly applying compost to the tree rows.
- (D) Control weed growth through regular herbicide application.



**SECTION I**

**Part B – 60 marks**

**Questions 21 to 26**

**Allow about 100 minutes for these questions**

**Answer ALL questions in the spaces provided.**

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**Question 21. (10 marks)**

Name ONE farm product you have studied –

Name of product: .....

*For the farm product you have named –*

- (a) (i) The farm that produces your studied product is part of the wider agri-business sector and is surrounded by service businesses.

Identify one of these services and describe two types of information that it can provide to the farmer (3 marks, 8 lines)

- (ii) For one of the two types of information described in (i), explain how it could be used to improve farm efficiency or productivity. (2 marks, 5 lines)

- (b) The following financial information was supplied by the owner manager of a dairy farm near Camden, for the year 2010 -

<b>Capital requirements: \$3,250, 000</b>
<b>Income from milk sales: \$1,500,200</b>
<b>Income from animal sales: \$60,000</b>
<b>Total Variable Costs: \$390,000</b>
<b>Total Fixed Costs: \$250,000</b>

- (i) Calculate the farm's % return to capital (to one decimal place) during 2010. Show working out. (2 marks, 5 lines)

- (ii) Describe one way this type of farm budget can be used by the farm business owner/manager. (1 mark, 3 lines)

- (c) For the farm product/farm that you have studied, explain how management can change in response to the dynamic (ever-changing) nature of markets. (2 marks, 6 lines)

**Question 22. (10 marks)**

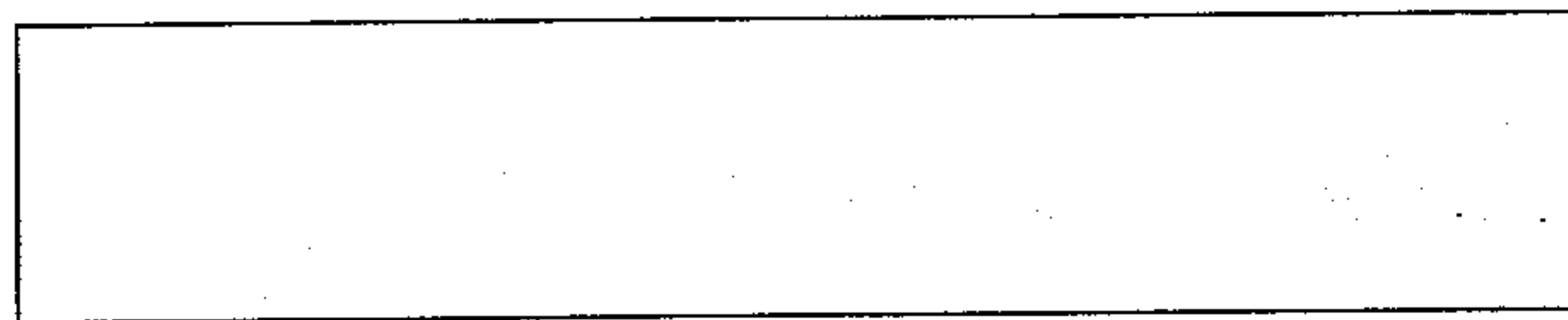
(a) A farmer has decided to set up a field trial to determine the best fodder crop density to control weeds.

The fodder crop, lucerne, is a highly nutritious legume that is both grazed by animals and cut, dried and baled to produce an excellent hay for storing in a hay shed and feeding out when pastures are low.

Lucerne is a perennial plant and if managed well should last at least six years before it gets too weedy.

The recommended seed sowing rate is 50kg/ha, however the farmer has noticed that weeds become too numerous after three years. The farmer is going to sow seeds at the following rates – 50kg/ha; 75kg/ha; and 100kg/ha.

The farmer has the paddock below to carry out the trial –



(i) In the paddock above, sketch out the trial, clearly showing principles of good experimental design. (3 marks)

(ii) Identify some appropriate measurements that the farmer should take to obtain a good comparison between the different seed sowing rates. (2 marks, 3 lines)

(b) For a crop that you have studied, identify an insect pest or disease and assess the recommended Integrated Pest (or disease) Management program that is used to control the pest or disease. (5 marks, 12 lines)



**Question 23. (10 marks)**

- (a) Describe the functions of the rumen microbes in ruminant animal digestion. (2 marks, 5 lines)
- (b) Describe management practices/techniques that beef cattle farmers use to optimise animal growth and development. (2 marks, 5 lines)
- (c) Evaluate the management techniques of Artificial Insemination and Embryo Transfer that are available to farmers to manipulate reproduction in farm animals. (6 marks, 16 lines)

**Question 24. (10 marks)**

- (a) The weaning weights of calves produced from three cattle breeding systems were compared.  
The calves were weaned off their mothers at 6 months of age.

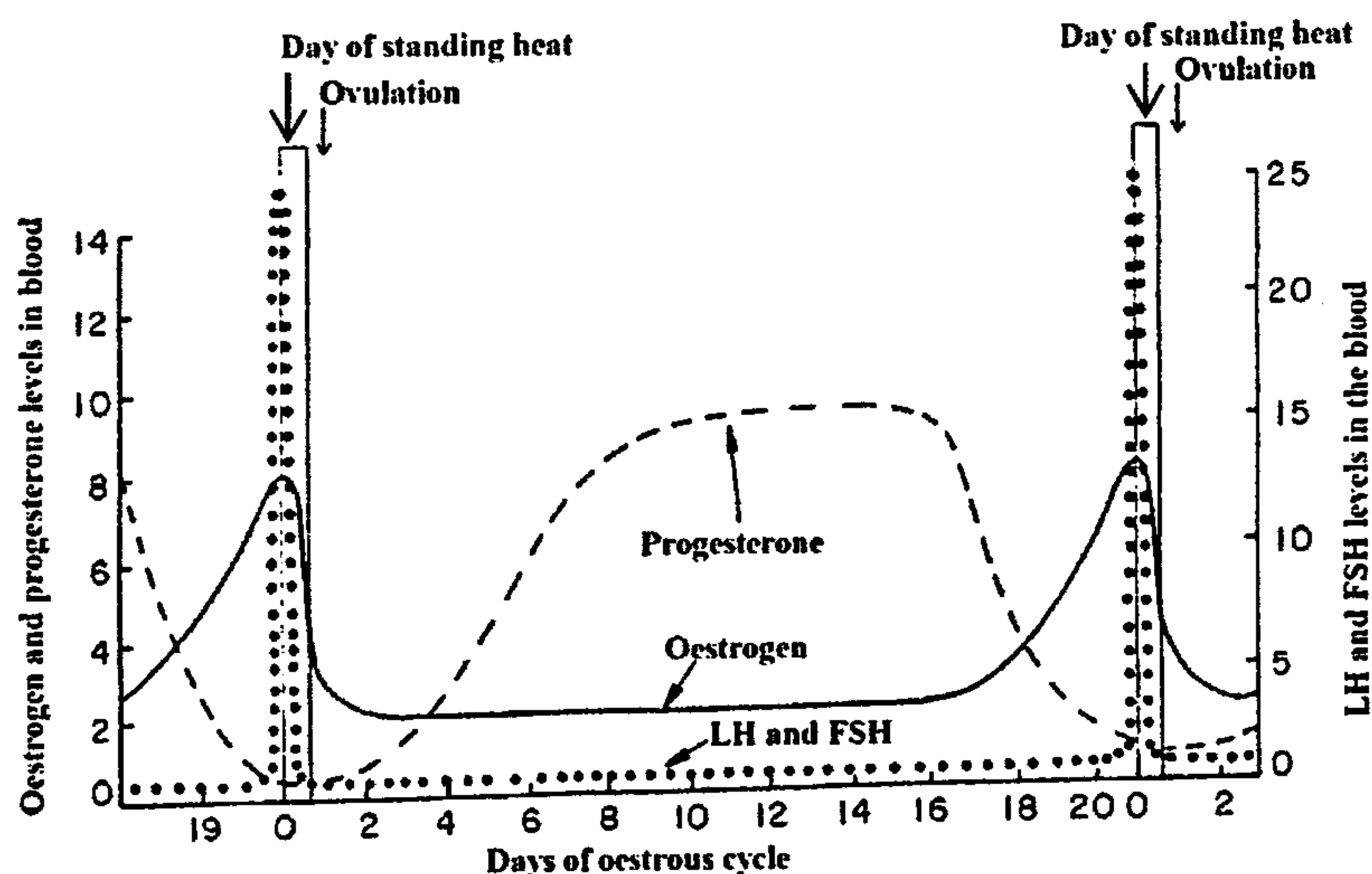
**Table: Average calf weaning weights gained from various breeding systems.**

Breeding system	Average weaning weights of calves (kg)
Breed A X Breed A	150
Breed A X Breed B	170
Crossbred AB X Breed C	210

Identify the purpose of crossbreeding in animal production. (2 marks, 5 lines)

- (b) (i) For a named farm animal, identify a husbandry operation that has a legal requirement to ensure that the animal's welfare is looked after.  
  
Animal: .....  
  
Husbandry operation:.....
  - (ii) Outline the legal requirements for carrying out the operation. (1 mark, 2 lines)
  - (iii) Identify ONE welfare benefit for the animal that is a consequence of the husbandry operation being carried out properly. (1 mark, 2 lines)
- (c) Describe THREE components of an Integrated Pest Management (IPM) program for the control of mastitis in dairy cattle. (3 marks, 8 lines)

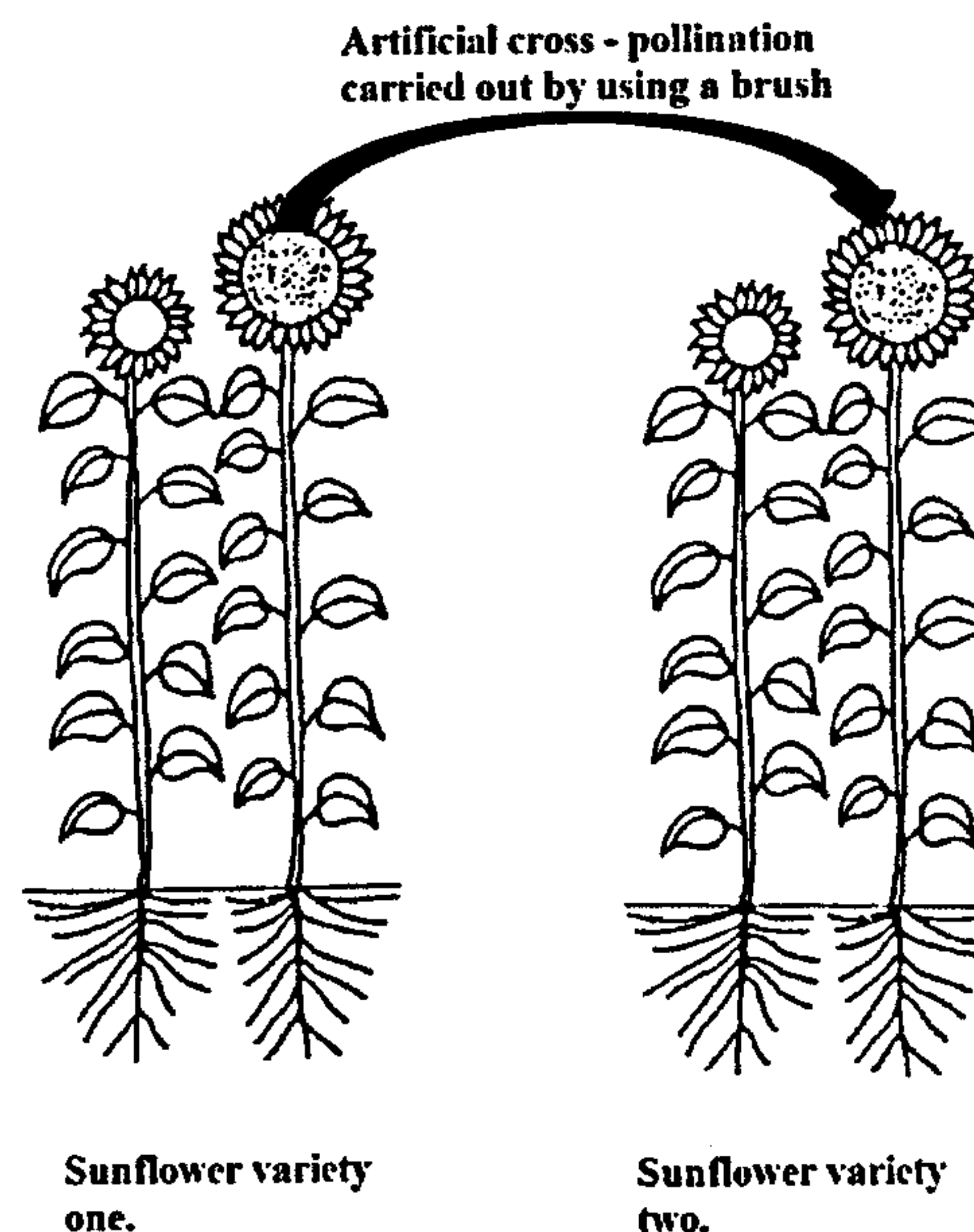
- (d) The graph shows varying hormone levels in the bloodstream of the cow from one heat period to the next, that is during the oestrous cycle. Ovulation occurs towards the end of each day of standing heat (heat period) and the levels of oestrogen, progesterone, Luteinising Hormone (LH) and Follicle Stimulating Hormone (FSH) vary greatly.



Describe how the levels of oestrogen and progesterone vary during the cow's oestrous cycle. (3 marks, 6 lines)

**Question 25. (10 marks)**

- (a) The diagram represents one method used by plant breeders to develop a new and improved plant variety.



- (i) Identify the method. (1 mark, 2 lines)
- (ii) Besides sunflowers, name one other agricultural plant that has been improved using this method. (1 mark, 2 lines)
- (iii) Genetically speaking describe the processes that are used to produce the new sunflower variety. (3 marks, 9 lines)
- (b) Describe the advantages and disadvantages of using legume/grass pasture mixes such as white clover and kikuyu or red clover and ryegrass (5 marks, 13 lines)



**Question 26. (10 marks)**

- (a) (i) During your studies you carried out a first-hand investigation to compare the structure and porosity (physical characteristics) of a variety of soils.  
*In step form*, describe the method you used. (3 marks, 8 lines)
- (ii) When a soil is well structured and porous, plant growth and productivity is high.  
Explain why. (3 marks, 7 lines)
- (b) Many farm practices have negatively impacted on water quality. This would include water in the local stream or creek and water quality in farm dams.  
*Describe and explain two* “on farm” practices that have adversely affected water quality.  
(4 marks, 10 lines)

**SECTION II**

**Electives – 20 marks**

**Choose ONE of the three electives, questions 27 to 29.**

**Allow about 50 minutes for this section.**

**Answer your chosen elective in writing booklets.**

**Ensure your student number is placed on each writing booklet that you use.**

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**Question 27. Elective – Agri-food, Fibre and Fuel Technology. (20 marks)**

- (a) (i) Outline the safety concerns that consumers have with genetically modified plant (food) products. (2 marks)
- (ii) Outline the legal requirements concerning the labelling of foods that contain genetically modified plant products. (2 marks)
- (iii) Discuss a current biotechnology development. (4 marks)
- (b) During your course you analysed a research study on the development of agricultural biotechnology.  
State the study’s aim, outline the importance of the research work and analyse the design and methods used. (12 marks)

**OR**

**Question 28. Elective – Climate Challenge. (20 marks)**

**OR**

**Question 29. Elective – Farming in the 21<sup>st</sup> Century. (20 marks)**

## HAHS – Agriculture Trial HSC 2011 – marking guidelines

Q1. – Q 20.	1. D; 2. B; 3. D; 4. A; 5. D; 6. A; 7. A; 8. C; 9. B; 10. B; 11. D; 12. D; 13. B; 14. C; 15. A; 16. D; 17. A or B; 18. D; 19. C; 20. D.	MC 20 marks
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### 12 Ag Trial HSC 2011- marking guidelines

Q21. (a) (i)	<p><b>Example: Dairy Express</b></p> <ul style="list-style-type: none"> <li>* For each cow in the herd – L milk produced during her lactation;</li> <li>* For each cow in the herd – measures of milk quality, eg. milk protein % or milkfat % (or kg protein/100L milk).</li> </ul> <p><b>Example: Veterinary practice</b></p> <ul style="list-style-type: none"> <li>* Advice on improving drenching program to improve parasitic worm control, including when to take faecal samples to test for worm numbers in animals.</li> <li>* Assessment of cow body condition and advice on improving nutrition to improve herd fertility.</li> </ul>			ID service correctly = 1 mark One type of <i>information</i> described = 1 mark Second type of info described = 1 mark	
(ii)	<p><b>Example: Dairy Express – milk protein %</b></p> <p>Too many cows have low milk protein levels and so the farmer decides to improve protein levels in the cows' diet, eg. boost feed supplements such as by-pass protein, lucerne hay or boost the legume content of pastures by sowing legume seeds into the pastures.</p> <p>Higher dietary protein will mean higher milk protein levels and bonus c/L from the dairy factory.</p> <p><b>Example: Vet and drenching program</b></p> <p>A more effective drench program will improve heifer calf growth, which will mean that she will reach first mating weight earlier and start producing milk earlier.</p>			Specific example/avoid generalisations for 2 marks Must explain how improves farm productivity.	
(b) (i)	<p>Total income = \$1,560,200</p> <p>Total costs (variable and fixed) = \$640,000</p> <p>\$ return = \$920,200</p> $\% \text{ return} = \frac{\$920,000}{\$3,250,000} \times \frac{100}{1} = 28.3\%$			½ mark ½ mark ½ mark ½ mark	
(ii)	<ul style="list-style-type: none"> <li>* % return can be <i>compared</i> with other investments or businesses or other types of farms and the farmer could decide to invest in another type of farm or other investments that produce a higher return.</li> <li>* Can be used to <i>compare</i> with previous years or to project forwards to determine when a bank loan will be paid off.</li> </ul>			How is the % return used? One use for 1 mark	
(c)	<p><b>Identify changing/dynamic market trend</b>, eg. demand for organically produced milk or concerns that milk is produced using animal welfare considerations or demand for milk varies such as over summer more milk is consumed, eg. flavoured milks</p> <p><b>Identify how dairy farmer has changed on farm practice in response to changing market</b>, eg.</p> <ul style="list-style-type: none"> <li>- farmer used no pesticides and artificial fertilizers when producing milk.</li> <li>- dairy cows are well protected from disease (annual vaccinations) and protected from excessive heat over summer (shade trees are planted and the cows can stand under sprinklers when waiting to be milked).</li> <li>- milk production is boosted by supplementing with silage and lucerne hay.</li> </ul>			→ 1 mark  → 1 mark	
Q22. (a) (i)	50kg/ha	75kg/ha	75kg/ha	100kg/ha	Shows randomisation → 1 mark Shows replication (at least 3 strips of each treatment) → 1 mark The complete paddock was used → 1 mark
	75kg/ha	100kg/ha	50kg/ha	50kg/ha	
	100kg/ha	50kg/ha	100kg/ha	75kg/ha	
(ii)	<p>Appropriate measurements –</p> <ul style="list-style-type: none"> <li>kg Dry Matter lucerne / ha</li> <li>kg DM lucerne / m<sup>2</sup></li> <li>g DM weeds / ha</li> <li>g DM weeds / m<sup>2</sup></li> </ul>				2 measurements for 2 marks



<p><b>Q22.</b> <b>(b)</b></p>	<p>Examples: Lettuces – sowthistle aphid; Cabbages – cabbage white butterfly.</p> <p><b>Points for –</b></p> <ul style="list-style-type: none"> <li>* Using a variety of practices such as pyrethrum insecticide, spraying herbicide to get rid of sowthistle weeds, introducing predatory wasps or ladybird beetles and growing aphid resistant lettuce varieties, maximises sowthistle aphid control.</li> <li>* Dangerous insecticides are used less and so environmental damage is reduced, eg. soil insects and earthworms, bees and Yabbies and fish in the local waterway are less likely to be killed.</li> <li>* As insecticide use is reduced, the targeted insects are less likely to develop resistance to the insecticides used.</li> </ul> <p><b>Points against –</b></p> <ul style="list-style-type: none"> <li>* Using a variety of practices means that the farmer needs to be more skilful to get the timing just right and to effectively carry out each practice.</li> <li>* Targeted pest kill is less than that obtained using just hard/ conventional insecticides.</li> <li>* Insect pest numbers will often take a little time to decrease and so the farmer should expect some crop damage.</li> </ul> <p><b>Judgement statement (reasoned) –</b> Through the use of a variety of practices, the IPM program is effective in controlling the targeted pest and as it reduces the use of conventional and dangerous insecticides, beneficial organisms are not killed and humans are not risking their health.</p>	<p>Assessing IPM program as a whole and not individual practices. Did not require a description of each IPM practice. Two points for → 2 marks Two points against → 2 marks Reasoned judgement statement → 1 mark</p>
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**Elective**

<p><b>Q27.</b> <b>(a) (i)</b></p>	<p>Examples: * Genetic modification often involves expression (production) of new protein that could be <b>allergenic or toxic</b>. * <b>Long term impacts</b> on human health of GM foods are not monitored. * <b>Antibiotic marker genes</b> are used to detect cells with inserted genes. <b>these antibiotic resistance genes could be transferred to gut bacteria.</b></p>	<p>Two X 1 mark = 2 marks</p>
<p><b>(ii)</b></p>	<p>If a food is a <b>GM food</b> or it contains <b>ingredients from GM plants</b> and so <b>new DNA</b> or <b>new protein</b> is present, within the food label must be the words “<b>genetically modified</b>” next to the relevant ingredient.</p>	<p>Two of emboldened phrases in the correct context for 2 marks</p>
<p><b>(iii)</b></p>	<p><b>Discuss = points for and/or points against.</b> <b>Example: Bio-pesticides –</b></p> <ul style="list-style-type: none"> <li>* these viral or bacterial or fungal based pesticides are very specific in that they kill the targeted insect only and so beneficial insects are not killed.</li> <li>* Bio-pesticides are a very useful additional practice that can be used in an IPM program.</li> <li>* Bio-pesticides take a little longer to kill the targeted pest compared to conventional pesticides and so the farmer has to accept some crop damage.</li> <li>* To gain maximum benefit from bio-pesticides, the farmer needs a Thorough knowledge of the insect’s life-cycle.</li> </ul> <p><b>Example: Sexed semen and embryos –</b></p> <ul style="list-style-type: none"> <li>* Dairy farmer can produce mostly heifer (female) calves during the year and the genetic merit and productivity of the herd will improve a little quicker.</li> <li>* The beef cattle farmer can produce more bull calves, as steers (castrated bulls) are higher meat producers compared to females.</li> <li>* Sexed semen straws are up to 5X the cost of un-sexed straws. Sexed embryos are also an added cost on top of a very expensive embryo transfer process.</li> <li>* Conception rates from sexed semen and embryos are very low – as low as 30 – 40%.</li> </ul>	<p>4 marks Four informative and correct points for. Can be either points for, points against or both. Each point must show a little depth of knowledge.</p>

Elective

<p>(b)</p>	<p><b>Biotechnology research –</b></p>	<p>1 mark</p>
	<p><i>Aim →</i>                  * To compare the effectiveness of four bio-pesticides (3 viral and 1 bacterial) in controlling <i>Heliothis</i> caterpillars in lettuce crops.</p>	
	<p><i>Importance of the research – two reasons →</i>                  * Lettuce crop losses from <i>Heliothis</i> caterpillars are high – 10%, in the Lettuce growing areas of Victoria.                  * The <i>Heliothis</i> caterpillar has developed resistance to all conventional insecticides.                  * Another practice to add to the IPM program that is used to control <i>Heliothis</i>.</p>	
	<p><i>Analysis of design and methods (analyse = identify components and comment on the importance of the relationships between components).</i>                  * Identify components of experiment’s design and research methods – Seven well described components, eg. bio-assay set up; replication; replication; control and other treatments; standardisation. →                  (could include field trial set up and then explain why the researchers did not continue with the field trial)</p>	<p>7 marks</p>
	<p>* Two comments on the importance/effectiveness of the relationships between the components(ie. the actual analysis) →</p>	
<p><b>Example answer:</b></p>		
<p>* The research was going to be a field trial with 25 plots of lettuces – each of the <u>five treatments (bio-pesticides gemstar, vivus, NPV and dipel and the control nil treatment)</u> were to be applied to 5 plots.                  Beneficial insect and <i>Heliothis</i> caterpillar numbers were to be counted before and after bio-pesticide applications.</p>		
<p>* The field trial was replaced with bio-assays in a lab after field numbers of <i>Heliothis</i> were found to be too low.</p>		
<p>Design and method for the bio-assays included the following –</p>		
<p>* At week 4, after lettuce seedling transplant, each of the bio-pesticides were applied to their five plots (in the field).                  Matching treatment to plot was a <u>random</u> process.</p>		
<p>For each of the five plots for a treatment, a leaf was <u>randomly</u> picked from the middle row (of 3 rows) of lettuces.</p>		
<p>* So five leaves were picked for each treatment.                  60 same sized leaf discs were cut from the five leaves.</p>		
<p>Into 30 same sized plastic cups was placed two leaf discs and one 2<sup>nd</sup> instar larva (<u>standardisation and replication</u>).</p>		
<p>* This means that there were 30 cups for each of the five treatments.</p>		
<p>* Larvae numbers still alive were counted 4, 5, 6, 7, 8 and 9 days after larvae were placed in their cups.</p>		
<p>Analysis –</p>		
<p>* It would have been more valid to complete the trial in the field as in-lab bio-assays are a little too controlled and unlike the on farm environment under which commercial crops would be grown.</p>		
<p>* Generally both the field trial and the bio-assays were well run, adhering to good experimental design principles and the bio-assays showed that each of the bio-insecticides were effective at killing <i>Heliothis</i>, especially after the third spray applications.</p>		
<p>* Some experimental design features could have been improved – for example – Replication – instead of five field plots per treatment, ten could have been set up and this would have made means (or averages) more accurate.</p>		
<p>* The trial should have included some conventional insecticides, so that a comparison between bio-insecticides and conventional insecticides can be made.</p>		



Q23. (10 marks)

(a) Functions of the rumen microbes include:

- They breakdown cellulose into volatile fatty acids.
- They synthesize vitamin B & K
- They make microbial protein from non-protein sources such as urea.

(four good points = two marks)

(b) Management practices/techniques that beef cattle farmers use to optimise animal growth and development include:

- HGP's (hormone growth promotants) – oestrogens that increase protein deposition and G & D.
- Feed additives example - non-protein nitrogen eg urea blocks are used when pastures are protein deficient.
- Selective breeding eg crossbreeding to produce offspring with optimum growth & development.

(four good points that were linked to optimising G & D = two marks)

(c) Evaluate the management techniques of AI and ET that are available to farmers to manipulate reproduction in farm animals.

Evaluate = description of technique, advantages, disadvantages and a judgement.

Artificial Insemination

Semen is inserted into the uterus and cervix of a cow using an AI gun.

Advantages:

- The genetic make-up of the herd can be improved faster with AI than paddock mating.
- There is a wide choice of proven AI sires (bulls), including semen from overseas bulls.
- Diseases that can reduce reproductive performance eg STD's are avoided.

Disadvantages:

- A calf produced through AI is more expensive than a calf produced through paddock mating.
- Conception rates with AI are less than with paddock mating.
- The AI technician or farmer needs to be experienced to gain max. success rate.

Judgement: AI is a procedure that a farmer with training can carry out and therefore its costs can be kept to a minimum. The improvements in herd genetic makeup and performance would make it worthwhile.

#### Embryo transfer

A superior cow is super-ovulated and A.I'd. her embryos are flushed from her reproductive tract. These embryos are then placed into recipient cows.

#### Advantages:

- The genetic make-up of the herd can be very rapidly improved.
- A large number of genetically superior calves can be born in one year.

#### Disadvantages:

- As ET needs the assistance of a vet, it is the most expensive method of producing a calf.
- The success rate for ET is less than that of AI and paddock mating.

#### Judgement

ET can very quickly improve herd genetic make-up and herd production, however its costs and success rate would make it uneconomic for a commercial farmer. A stud farmer who sells quality animals to other farmers may find ET economically worthwhile.



Q24. (10 marks)

- (a) Crossbreeding is used to produce **superior** performing animals. Offspring often inherit the best qualities from both breeds. They often display **hybrid vigour** and are **more productive** than either of the **parent breeds** eg weight gain or growth. It is used to increase **genetic diversity**.

(four points well identified = two marks)

- (b) (ii) eg mulesing can only be carried out by a farmer on lambs that are **under 12** months of age. A vet can perform the operation if the sheep is **over 12** months.

(two points = one mark)

- (iii) mulesing (as a result of the removal of skin from the breech area) gives protection to sheep from flystrike.

(two points = one mark)

- (c) **THREE** components of an IPM program for the control of mastitis in dairy cattle include:

- **Management** – hygiene, teat dipping, RMT, lane maintenance and prevention of cross infection.
- **Chemical** – use of detergent and antibiotics (low dose during lactation & a higher dose for dry cow therapy).
- **Genetic** – cull genetically susceptible cows.

(six good points = three marks)

- (d) The levels of oestrogen and progesterone vary during the cow's oestrous cycle.

Before the day of standing heat, oestrogen levels rise rapidly. It remains high during heat and then rapidly decreases. Oestrogen then remains low and constant for the rest of the cycle. After the heat period, progesterone levels rise rapidly and remain high and constant between heat periods. It drops before the next heat cycle.

(six good points = three marks)

### Question 25

A)i) identify the method

Answer: Cross breeding/hybridisation ( not cross pollination as written on picture) 1 mark

ii) Besides sunflowers, name one other agricultural plant that has been improved using this method

Any agricultural plant was accepted, eg, wheat, corn, barley etc 1 mark

iii) Genetically speaking describe the processes that are used to produce the new sunflower variety 3 marks

Looking for answers that talk about the following characteristics

- Has both characteristics/traits of parents
- Hybrid vigour
- Done over multiple generations
- Desirable characteristics by selection
- Homozygous parents then have a heterozygous offspring, selection of traits wanted then breed together, bad traits taken/not selected.

25 b)

Describe the advantages and disadvantages of using a legume/grass mixes such as white clover and kikuyu or red clover and ryegrass 5 marks

Want 2 really good examples for each adv or disadv or 3 for each if mediocre

2.5 marks for advantages

Eg:

- Addition of N to soil
- Decrease need for fertilisers
- Increase nutritional value
- Increase in soil fertility
- Increase in production of stock
- Balanced feed for stock
- Provide organic matter to soil
- Mulched into the soil

2.5 marks for disadvantages

Eg:

- Expensive to maintain/setup
- Re-sowing required due to competition for grasses
- Over consumption of legumes -> bloat
- High cost of initial seed
- Management costs, eg irrigation, fertilizer application etc



26)a) i)

During your studies you carried out a first hand investigation to compare the structure and porosity (physical characteristics) of a variety of soils. In step form, describe the method you used. 3 marks

- Soil samples taken
- Set up of filter paper and funnel and measuring cylinder
- Weight of soil or water used taken
- Water added and filtered through
- Weight of soil or mls of water that filtered through measured
- Must say repeated for accuracy and compared with other results

ii) when a soil is well structured and porous, plant growth and productivity is high. Explain why

3 marks

Was looking for 3 good points

Eg.

- Allows availability of N and minerals
- Easy infiltration of water
- Holds water
- Arrangement of soil particles
- Increased aeration levels, infiltration, storage and drainage rates
- Root penetration and growth
- Transfer of heat within soil
- Temperature of soil
- Susceptibility of the soil to erosion is lessened.

b) Many farm practices have negatively impacted on water quality. This would include water in the local stream or creek and water quality in farm dams.

Describe and explain two "on farm" practices that have adversely affected water quality. 4 marks

Need TWO on farm practices- says the practices and gives a brief description on how it affects the waterway

Eg. - Use of inorganic fertilizers -> eutrophication

- Animal access to water/creeks/stream -> increase in turbidity and lack of oxygen in water
- Clearing of lands -> less water uptake and also increase in erosion into waterways
- Clearing of lands -> increase in salts to the surface
- Overstocking -> erosion