



Cambridge Assessment International Education
Cambridge Ordinary Level

AGRICULTURE

5038/12

Paper 1

October/November 2017

MARK SCHEME

Maximum Mark: 100

Published

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This document consists of **24** printed pages.

Question	Answer	Marks
1(a)(i)	hygienic; durable, against water / wind for example; secure, harder to dig through for escape / predators / theft; fire resistant;	1
1(a)(ii)	good insulation; allows air to circulate; warmer in winter / cooler in summer; locally available; (<i>Accept only once.</i>) low cost;	1
1(a)(iii)	no specialist equipment needed; quick to install; locally available; (<i>Accept only once.</i>) easy to replace when needed; very cost effective / cheap; liquid waste drains away;	1
1(b)	cost; rust / corrosion; blow off in high winds; not locally available; too cold in cool months / too warm in warm months; condensation; noisy when it is raining;	2

Question	Answer	Marks
1(c)	<i>Explanation is required for full marks.</i> concrete is hard / flat / impervious; therefore is easier to clean / sweep / disinfect / more hygienic / saves time; does not harbour pests; more durable against running water for example; more secure (harder to dig through for escape / predators / theft); stronger / does not break easily; makes building multiple use, e.g. to store feed / equipment; cools the building; keeps animals / birds inside / predators out; does not become waterlogged / tread up / get muddy; <i>Accept reverse arguments.</i>	2

Question	Answer	Marks
2(a)(i)	14 – 6 = 8 kg gained 320 – 56 = 264 days <i>(both required for 1 mark);</i> 8 / 264 = 0.030; (allow 30.30 as below) <i>(Credit 1 mark for value. Allow ECF.)</i> kg per day / g per day to match value; <i>(Credit 1 mark for correct unit.)</i> <i>Full marks for correct answer with its correct unit.</i>	3

Question	Answer	Marks
2(a)(ii)	food conversion ratio; mortality (rate); (concentrate) food intake; feed costs; vet costs; labour; example of relevant variable cost; example of relevant fixed cost; output / income / profit; price per kg / annual fluctuation in market / abattoir / store prices; milk production; breeding records, e.g. birth rate; health records, e.g. vaccination records;	3
2(b)	period of time when milk is produced by an animal;	1

Question	Answer	Marks
3(a)(i)	<i>Accept any correct example of a fungal plant disease.</i> e.g. damping off / mildew / rice blast / rust / wilt / rots / blight / blotch / smut / ergot; <i>Accept a correctly named fungal pathogen, e.g. Botrytis / Armillaria / Phytophthora / Fusarium / Verticillium etc.</i>	1

Question	Answer	Marks
3(a)(ii)	<i>Allow specific or general effects.</i> reduced yield; damage stem / leaves; wilting; stunting / reduced growth; defoliation; yellowing / discolouration of leaves; marginal necrosis; reduced photosynthesis / photosynthetic tissue; damaged / mouldy / rotten fruit; produce toxins / bad smells; plant dies; clogged vascular tissues / prevent uptake / translocation of nutrients;	3

Question	Answer	Marks
3(b)	fungicides / pesticide; kills fungus on growing or mature plants and fruits; seed treatment; know seed is fungus free – reduces fungal burden in crop; soak seeds in hot water to kill spores; reduces fungal burden in crop; use certified seeds; know seed is fungus free, reduces fungal burden in crop; use resistant varieties; crop is not affected by fungal disease; transplant healthy seedlings; know seedlings are fungus-free – reduces fungal burden in crop; crop rotation; disrupt pathogen life cycle / avoid disease; good hygiene / cleanliness; use clean tools / machinery / cultivation; removes disease spores from crop; remove crop residues / plant debris / affected plant parts; remove diseased and dead / yellow leaves; prevents disease being harboured / slows growth of fungi; use atmospheric solutions (create warm, dry, fresh conditions); low humidity reduces fungal spread; enough space between plants / create air movement if indoors; low humidity / density of plants slows fungal spread;	4

Question	Answer	Marks
3(b)	grow plant in area less suited to fungal disease; lower frequency of fungal disease; early planting; plant is established before fungus takes effect; <i>Accept relevant biological control, e.g. use of fungus which attacks pathogenic fungi.</i>	

Question	Answer	Marks
4(a)(i)	X on the diagram anywhere in the vagina;	1
4(a)(ii)	sigmoid flexure straightens / grows in size / becomes longer / larger / swells / becomes erect / hard / stiffens;	1
4(a)(iii)	to make them quieter; less vicious / less dangerous; easier to handle / easier to harness; to remove a diseased organ; to prevent transmission of sexual diseases; to control mating / only the best bulls breed / cannot mate ; gain mass / grow more quickly; animals less stressed / to stop males fighting; meat is better / has better fat distribution / meat is not tainted;	2

Question	Answer	Marks
4(b)	<i>Award 1 mark for each completely corrected section.</i> <i>the day before birth:</i> udder swells / becomes larger / fills with milk; vulva swells; pin bones widen; mother feels baby moving; mother isolates itself / becomes restless / nervous; (Accept animal specific behaviours.) vaginal discharge / lubrication; pelvis relaxes; <i>at birth:</i> cervix dilates; waters break; vaginal discharge; pushes / strains; has contractions; <i>shortly after birth (mother):</i> mother licks calf; mother feeds calf; umbilical cord breaks; mother passes after-birth / cleansing / placenta; mother may eat placenta; <i>shortly after birth (offspring):</i> offspring starts to breathe; offspring tries to stand up; offspring finds teats / suckles; offspring drinks; drinks colostrum / first milk;	4

Question	Answer	Marks
4(c)	<i>Explanation required for full marks.</i> crushing; calf gets stuck / takes a long time to come out; need to pull harder / cannot get calf out; lungs fill with fluid; could suffocate; delayed labour; cord stuck around calf's neck when going backwards;	2

Question	Answer	Marks
5(a)(i)	B, C, D, A labelled clockwise from top of the diagram. <i>4 correct for 2 marks. 2 correct or 3 correct for 1 mark.</i>	2
5(a)(ii)	<i>Credit one mark for each stage and one mark for a reason.</i> B / egg; D / pupa; they do not eat / bore into / transmit disease to the crop / no mouthparts; <i>Allow ECF based on candidate's answers to (a)(i).</i>	3
5(b)(i)	<i>Correctly named piercing and sucking pest for 1 mark.</i> e.g. aphids, bagrada bugs, mealy bugs, scale insects, leafhoppers, thrips etc.; <i>Credit 1 mark for an example of relevant damage.</i> e.g. decreased growth rates / disease introduced / impact of disease, e.g. mottled leaves / wilting / low yields / lack of vigour / crop death / stunted growth / curled leaves / loss of sap / suck sap / juice / loss of nutrients / virus vector / fungal coating of plants, e.g. from honeydew; <i>Allow ECF for correct damage given for an incorrect pest.</i>	2

Question	Answer	Marks
5(b)(ii)	cultural example, e.g. pests removed / crop rotation / companion planting / time of planting / biological control example, e.g. predator-prey; spray with chemicals, e.g. pesticides / insecticides / named example; genetic control, e.g. sterile males;	1

Question	Answer	Marks
6(a)	balanced / consistent diet / ration; gives a varied diet / variety of nutrients / vitamins / trace elements; easier ration management; maximise animal performance; improved feeding efficiency; can take advantage of seasonal / cheap food sources; reduces labour / time to feed; improved digestibility; improved palatability / flavour; reduced risk rumen upset / acidosis; provides fibre to aid gut movement / prevent constipation;	3
6(b)	cost per 1 kg gain = 0.04×8 ; = \$0.32; cost per 5 kg gain = \$1.60; (Allow ECF for $5 \times$ any worked cost for 1 mark.) Full marks for correct answer.	3
6(c)(i)	more labour / time; more processing; more fuel / transport; storage;	2

Question	Answer	Marks
6(c)(ii)	cheaper than disposal as waste; to reduce feed costs / feed buying costs; to meet a specific feed requirement; to take advantage of seasonal / local resources; variety; palatability;	1
6(d)	<i>ruminant:</i> can digest grass / can digest cellulose / more material; gut microbes can make protein / essential amino acids; gut microbes can synthesise vitamins (B and K); less energy lost as digestion process more efficient; can chew cud, allowing greater extraction of nutrients; absorption in rumen (and other stomachs) as well as intestines; <i>ORA for non-ruminant.</i>	2

Question	Answer	Marks
7(a)(i)	parents Rr x rr; gametes r r; offspring Rr Rr; phenotype smooth smooth; <i>Allow ECF.</i>	4
7(a)(ii)	<i>heterozygous:</i> an individual has one each of two different alleles / has different alleles; <i>phenotype:</i> the appearance / features of an organism (resulting from inherited information / genes);	2

Question	Answer	Marks
7(b)	D;	1
7(c)	select cultivars with suitable characteristics; cross these to produce offspring / next generation with improved characteristics; select again for suitable characteristics until cultivar breeds true; over many generations;	2

Question	Answer	Marks
8(a)(i)	phosphorus;	1
8(a)(ii)	B;	1
8(b)(i)	liming; add an alkali / named alkali;	1
8(b)(ii)	because acidity can vary over time; to allow maximise nutrient availability; to know how much lime / alkali to add for optimum crop growth; agricultural processes, e.g. irrigation / fertiliser application can change pH;	1
8(b)(iii)	to find a reliable (field) average / to find a reliable average for a specific area / to understand the different acidity of different areas / to be able to differentiate liming / fertiliser application / to be able to map the field for acidity;	1

Question	Answer	Marks
9(a)	method of growing plants using mineral / nutrient solutions; in water; without soil; roots in the nutrient solution only / or in an inert medium, such as perlite or gravel;	2

Question	Answer	Marks
9(b)(i)	less space required / more space for another crop; more automation possible; increase productivity / yield; better quality of product; constant supply of nutrients; do not need to use scarce land / soil; fewer pests and diseases; it allows crops to be grown in regions where there is no soil; shorter growing cycle;	2
9(b)(ii)	high setup costs; specialist equipment needed; skilled staff needed; supply of water needed; electricity needed; not suitable for all crops; some plants have to be supported; ease of disease spreading;	1

Question	Answer	Marks
10(a)	movement of synthesised food; sugar / sucrose / nutrients transported; made in photosynthesis; dissolved in water; from leaves; to storage organs / other tissues; through (living) phloem cells; active transport; needs energy (from respiration); carbohydrate stores (complex);	4

Question	Answer	Marks
10(b)	photosynthesis; synthesis of carbohydrates / glucose; mainly in leaves / palisade cells; carbon dioxide and water used; chlorophyll / chloroplasts; light / energy required;	5
10(c)	mineral ions are dissolved in soil water; through the roots; root hairs increase surface area for absorption of soil water; water / nutrients enter through root hair cell; osmosis; active transport; ion exchange; travel through the xylem to where required in the plant; concentration gradient ref. explained; symbiotic relationships, e.g. fungi to enhance root surface area; positive pressure from roots (push of root gradient); negative pressure from leaves (pull of leaf gradient); transpiration pull / stream;	6

Question	Answer	Marks
11(a)	abnormal temperature; lethargy; hair loss / rough coat; abnormal faeces / blood / worms / very runny / sticks to fur / feathers; dark / blood urine; no appetite / will not eat; watery / dull / sunken eyes; weight loss despite eating; rib cage stands out; isolated; poor stance / head down / drooping; cough / sneeze / nasal discharge; panting / breathing fast; dry / runny nose; erratic behaviour / aggression; visual parasites;	5

Question	Answer	Marks
11(b)	<i>Max. 3 marks for either how disease is transferred or how it is avoided alone.</i> <i>Allow a development mark / an example for detail in either section.</i> <i>direct contact – transfer of microorganisms through:</i> oral secretions; lesions; spores; licking; rubbing; <i>indirect contact:</i> contaminated food; contaminated water; dirty walls; dirty troughs; droplet contact; airborne transmission; faecal transmission; through vectors; <i>avoidance:</i> good hygiene, e.g. regular cleaning of walls / floors / disinfectants / clean bedding; foot baths; good drainage; vaccination; quarantine / movement restrictions; identify and treat sick animals; regular health checks on animals; isolation of sick animals; dispose of dead animals hygienically; correct feeding; fencing / barrier to other farms; avoid stagnant pools / places where microbes / mosquitos could breed; handler cleanliness / protective clothing / change clothes; dips;	4

Question	Answer	Marks
11(c)	<i>Allow an example disease used in explanations for one mark.</i> damage organ function, e.g. liver fluke; low growth rate; reduced eating; animal more susceptible to other illnesses / bring diseases; irritation; lack of coat quality; damage product; death; take host's food; reduced growth rates / later finishing / mass loss; less saleable; lower output / income / profit; increased vet / medicine costs; increased feed costs;	6

Question	Answer	Marks
12(a)	the process by which pollen is transferred; from the anther; to the stigma; of the same species; by wind / by insects;	3

Question	Answer	Marks
12(b)	<i>Maximum of 4 marks for structure or function alone.</i> <i>structure:</i> lots of pollen / light pollen; no nectar; exposed / hanging stamens; long filament / hanging anther; small flowers / petals; dull / green / brown flowers; tall; <i>function:</i> adapted for wind pollination; <i>male:</i> pollen is light to be carried by the wind; produces large volumes of pollen because wind pollination is random; pollen is released easily by wind movement; <i>female:</i> stigma / style / silk hang outside to collect pollen easily;	6

Question	Answer	Marks
12(c)	<i>asexual:</i> one parent / single organism; no gametes; vegetative reproduction; no flowers / pollen / pollination / fertilisation; genetically identical offspring; mitosis; cloning; example of method, e.g. cutting / grafting / layering / bulbs / suckers / crowns / corms / rhizomes / stolons; example of crop, e.g. banana / sugar cane / yams; <i>sexual:</i> flowers; male sex cells – pollen (nuclei); female sex cells – ovules; pollination / fertilisation; fusion of (male and female) gametes; must meet for reproduction; <i>Accept reverse arguments.</i>	6

Question	Answer	Marks
13(a)	<i>No mark for crop. Actions must be appropriate to crop choice. Max. 2 marks for each section.</i> <i>preparation:</i> choose crop to suit conditions; choose planting material; plough / dig / turn the soil; timing; raking; cultivation detail – soil tilth / seed-bed / ridges and / or furrows; fertiliser; pesticide; manure; <i>sowing or planting:</i> broadcast / planter / drill / seed-box / germinate / propagate / soak seeds; sowing depth; between plant spacing; within row spacing; watering; cuttings / tubers; <i>growing on:</i> control pests; control diseases; control weeds; fertiliser application; monitor / crop walks; watering / irrigation; harvesting;	4

Question	Answer	Marks
13(b)	<i>Credit 1 mark for weed example.</i> <i>harmful effects:</i> reduce yield; compete for water; compete for nutrients; compete for light; compete for space; increase cost of production; reduce quality / contaminate produce; toxic / harmful to crop / consumer; harbour pests / insects / diseases; block waterways; reduce value of land; faster wear and tear of farm implements; <i>how spread:</i> wind; water; animals; people;	5

Question	Answer	Marks
13(c)	<i>Allow any 6 points:</i> clear the soil of existing weeds before planting crop; weeding regularly helps prevent weed spreading; <i>cultural methods:</i> break life cycle; e.g. rotation; intercropping; under sowing; fast-growing varieties; removing crop residues; flooding; timely planting; timing of harvest; mulching / covering soil; <i>mechanical methods:</i> e.g. harrow / hoe / cut; pull up; ridge / plough in / remove rhizome from soil; burning; <i>chemical methods:</i> spraying herbicide / named chemical; weed wipe; contact; systemic;	6

Question	Answer	Marks
14(a)	small particles; slow to warm up; small air spaces / poorly aerated; poor drainage; good water-holding capacity; not easily leached; not easily eroded; hard to cultivate / heavy / sticky soil; lots of nutrients; cracks when dry; prone to waterlogging; may contain few / fewer rocks / pebbles;	4
14(b)	minimum tillage; reduce compaction; sub soiling; reduce salinity / soil pans; do not over water; effective drainage; avoid monoculture; do not cultivate when soil is wet; low pressure tyres; avoid overstocking / do not let animals poach the ground / avoid bottlenecks; plough before frosts; increase humus / organic matter; use green manures; lime to raise pH / reduce acidity; avoid mixing top and subsoil;	6

Question	Answer	Marks
14(c)	affects water availability, high temperatures cause increased evaporation / transpiration; low temperatures reduce availability of liquid water / frozen water cannot be absorbed; affects rate of photosynthesis through effect on enzyme-catalysed reactions; required temperatures for flowering / growth for certain species, which affects crop quality; temperature affects soil microbes impacting nutrient availability and soil structure; slower uptake of nutrients by roots; freezing causes ice crystals which damage cells; seedlings more vulnerable to extremes of temperature; seedling germination is triggered at certain temperatures for some species; plants can wilt due to water stress;	5