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AGRICULTURE **0600/11**

Paper 1 Theory **October/November 2024**

MARK SCHEME

Maximum Mark: 100

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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PUBLISHED

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	‘List rule’ guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Question	Answer	Marks
1(a)(i)	A;	**1**
1(a)(ii)	D;	**1**
1(a)(iii)	B;	**1**
1(b)(i)	disease / pest / weed resistance; reduced chemical, e.g. herbicide / pesticide (costs); reduced machinery / labour / training / fuel cost; reduced input costs; drought resistance; higher yields / larger fruit / more produce to sell; allergy causes can be removed / suitable for specific diets; nutritional additions, e.g. vitamins / health benefits; enhanced flavour; increased shelf-life; higher growth rate;	**2**
1(b)(ii)	*Way and linked explanation for 2 marks.* concerns about the possible health risks / allergies; lack of demand from consumers / not able to sell / need to sell at lower price; cannot keep own seed to regrow; genetically modified (GM) / bought in seeds are expensive; specific expertise / training / labour need; adds to input costs; expensive to buy genetically modified (GM) seeds; increases costs; crops may require expensive fertiliser(s); higher fertiliser cost / higher input costs;	**4**

Question	Answer	Marks
2(a)	one mark for labelling the top soil (as top layer); one mark for labelling the subsoil (between bottom layer and top layer);	**2**
2(b)	*Reason and explanation for 2 marks. A maximum of 2 marks are available for reasons alone. Accept other valid reasons and explanations.* plant roots do not reach the water; because roots do not penetrate far in the soil; plants may be deficient in nutrients needed / crop roots cannot reach the nutrients / soil has low water-holding capacity; because in sandy soil there is low organic matter to hold nutrients / nutrients are leached; plants wilt; because plants do not receive / take up enough water; water is deeper in the soil / plants receive insufficient water; because water drains quickly / easily; roots pull out easily; because roots are weakly anchored / held in the soil; plants are removed with eroding soil / lack soil to grow in / roots are exposed; because sandy soil is more prone to soil erosion; suffer from heat stress; sandy soil heats more rapidly;	**4**

Question	Answer	Marks
2(c)	spread (compound) fertiliser; spread manure; add compost; add organic matter; liming; a layer of mulch; irrigation; plant a shelter belt; provide shade; *Accept other suitable suggestions.*	**2**

Question	Answer	Marks
3(a)(i)	*1 mark for suggestions for suitable temperature and 1 mark for suggestions for sufficient water.* *a suitable temperature:* heating system / windows which open and / or close / blinds / shades / tinted glass / insulation / ventilation / air conditioner / thermostat; *sufficient water:* irrigation system / automation / using a timer / computerised / by hand / by watering can / at the least wasteful time / when not too hot;	**2**

Question	Answer	Marks
3(a)(ii)	*1 mark for how to control each of two conditions, for example:* *light intensity:* lighting / shades / blinds / specialist glass; *air movement:* air movements inside building controlled with more ventilation / fans; *level of carbon dioxide:* sealed building / pump to circulate carbon dioxide / supply of carbon dioxide; *humidity:* dryer / water mister / spray;	**2**
3(b)	*1 mark for cold and one mark for dry.* *cold:* growth rate is slowed / below optimum temperature for growth / reduced rate of enzymatic reactions of growth / freezing can kill plants / burst cells / reduce nutrient uptake / photosynthesis is slowed / transpiration rate / rate of water loss from plant is slowed down; *dry:* growth rate is slowed / water is a requirement for photosynthesis / water is needed to absorb minerals from the soil / water is needed for translocation / speeds up transpiration rate / water loss from plant;	**2**
3(c)(i)	14 / 14.29 / 14.3; *Accept unrounded answer.*	**1**

Question	Answer	Marks
3(c)(ii)	less (chemical) pollution / fewer environmental concerns / (more) environmentally friendly / more biodiversity on the farm; availability of chemicals and machinery; lack of specialist equipment; local laws; to maintain organic status; own farming ethos / sustainable principles; higher cost of purchasing chemicals; need for specific training / expertise;	**2**

Question	Answer	Marks
4(a)(i)	nitrites are converted into nitrates – nitrification; nitrogen from the air is processed by bacteria – nitrogen fixation; soil nitrates are converted into nitrogen gas – denitrification;	**3**
4(a)(ii)	nitrogen fixation;	**1**
4(b)	legume roots bind soil; soil is not bare / harder to blow away / soil erosion reduced; legumes enhance soil (crumb) structure; increase organic matter in soil; legumes can increase soil fertility (in ways other than fixing nitrogen); legumes help soil to drain well / not too fast / to reduce water run-off; legumes help water to move through the soil more slowly / help soil to retain moisture / help to reduce leaching; *Ignore reference to adding nitrogen.*	**2**

Question	Answer	Marks
5(a)	(the combination of genetic information) from two parents; male and female involved; gametes / two gametes involved; fusion (of gametes / sex cells / example of male and female sex cells); form a zygote; involves fertilisation; genetic information mixes; offspring are not identical to parents; sexual reproduction leads to variety in the offspring / genetic variation;	**2**
5(b)(i)	the process by which pollen is transferred / transfer of male gametes; from an anther to a stigma;	**2**
5(b)(ii)	*Feature and explanation for 2 marks. A maximum of 2 marks are available for features alone.* brightly coloured petals; attract more pollinating insects; large / heavy pollen; falls off insect body parts when the insect visits another flower; sticky pollen; easily carried on the body of an insect; sticky stigma; can catch pollen as insect passes / brushes against; nectar / scent; attracts (more) insects to the flower; honey guides; direct the movement of pollinators;	**4**
5(c)	to increase the level of fertilisation / to increase seed / fruit production / crop yield;	**1**

Question	Answer	Marks
6(a)	ruminants digest their food by passing it through four / multiple / complex stomach chambers / non-ruminants pass food through one / simple stomach chamber; in ruminants microorganisms provide protein for animal; ruminants regurgitate food (non-ruminants do not); ruminants digest cellulose (by bacteria in gut); ruminants regurgitate / chew the cud (non-ruminants do not); rumen present in ruminant (not present in a non-ruminant); reticulum present in ruminant (not present in a non-ruminant); omasum present in ruminant (not present in a non-ruminant); abomasum present in ruminant (not present in a non-ruminant); *Accept other relevant differences.*	**2**
6(b)	*1 mark for each organ for a main function.* *large intestine:* absorption of water / passes waste (to the rectum / anus); *oesophagus:* physical digestion / peristalsis / mixing / passage of food / water to stomach; *small intestine:* digestion / nutrient absorption; *liver:* production of bile / emulsification of fats; *Accept other main functions.*	**4**

Question	Answer	Marks
7(a)	*1 mark for meaning of each of maintenance ration and production ration.* *maintenance ration:* the amount of food given to maintain basic body functions / keeps an animal in good health / helps the animal maintain a constant body weight; *production ration:* enables mass gain / growth / lactation / reproduction / more food than a maintenance ration / basic need / example of production linked to food given, e.g. production of meat / milk / eggs / can do work;	**2**
7(b)(i)	isolate sick animals; vaccinate; monitor for / treat illness quickly; keep accurate / up to date records; import disease-free animals / maintained a closed herd / flock; provide sufficient clean water / do not use contaminated water; reduce stocking density; provide multiple / spread out water and feed troughs; regular cleaning of housing / equipment / good hygiene; disinfection / example, e.g. use of foot bath / dipping; effective ventilation; separate juvenile and adult animals; remove contaminated bedding; host regular preventative veterinary visits / include the veterinarian in farm planning discussions; feed a ration rich in nutrients / protein / carbohydrate / minerals / vitamins; *Accept other appropriate actions.*	**2**

Question	Answer	Marks
7(b)(ii)	*Description and explanation needed for 2 marks, for example:* impaired health / immunity / risk of diarrhoea; loss of condition / increased risk of contracting disease / death; reduced reproduction; lack of livestock offspring to sustain herd / sell; may transfer disease to other livestock; weaker animals / reduced growth rates / extended finishing time / increased veterinary costs; death of livestock; fewer animals to sell / need to buy replacements; can cause blood loss / anaemia; animals generally unwell / less healthy / do not thrive / have less energy; reduced growth / slower growth rate; lower production / output; reduced productivity / loss in mass / later finishing; production costs increased / production cycle extended; parasites take host's food / reduced / increased appetite; reduced growth rates / increased feed costs; lower overall output / reduced prices for animals; reduced income / profit; can reduce product quality, e.g. hide damage / product condemned; less saleable output / reduced prices;	**2**

Question	Answer	Marks
8(a)	the number of animals which a grazing system can support / sustain / tolerate;	1
8(b)	*1 mark for a correct suggestion for each of bush control, monitoring stocking rate and controlled use of fire.* *bush control:* to avoid the (over)growth of non-palatable species; to avoid the growth of toxic species; to retain enough plant coverage to minimise soil erosion and / or desertification; to manage the regrowth of palatable bush species; bushes can harbour predators / pests; *monitoring stocking rate:* to avoid overstocking / overgrazing; to minimise pasture loss; to reduce disease incidence / transfer / pasture pest burden; to avoid understocking; to avoid damage to pasture / soil; *controlled use of fire:* to generate regrowth of forage; to help control pests; some plants need fire to grow; so as to avoid destroying grazing and / or shelter; so animals are not injured / killed in fire;	3
8(c)(i)	as the number of animals per paddock increases, the percentage mass increase decreases;	1
8(c)(ii)	*1 mark for each correct reason.* competition for food increases / less food is available for each animal; there is a potential increase in pests / parasite burden; disease spread can increase; animals become more stressed and lose appetite; animals are more likely to bully other animals and prevent them from eating; increased risk of faecal contamination of forage (resulting in animals not wanting to eat);	2

Question	Answer	Marks
8(c)(iii)	gender / gender mix; age of animal; breed; starting mass; weather / climate; predator incidence; quality of grazing; parasite burden; medical treatments / supplements; *Accept other valid variables.*	**2**

Question	Answer	Marks
9(a)	DD; Dd / dD;	**2**
9(b)	*parent genotypes:* Dd x Dd / D d x D d; *offspring genotypes:* DD Dd dD dd; *expected ratio:* drought resistant : not drought resistant 3 : 1;	**3**

Question	Answer	Marks
9(c)(i)	growing crop needs less water; crop is less likely to lodge / fall down; plants are less likely to die due to water / heat stress; irrigation costs can be reduced; crop puts more resources into grains than stems / higher (relative) grain yield; farmer can grow the crop in more areas / climates, e.g. dry / windy; less time needed / quicker to harvest crop; lower costs of waste / crop residue disposal; a minimum tillage system is used / easier to direct drill the next crop;	**2**
9(c)(ii)	selective breeding / crossing plants with short stems;	**1**

Question	Answer	Marks
10(a)	remove stones / rocks; clear land of vegetation / previous crop / weeds; cultivate soil by ploughing / digging; (cultivate soil to) fine tilth; add fertiliser; add organic matter / manure; add lime (if required); create planting hole / pockets / drill; pre-emergent weed herbicide / pest control; control / treat existing disease; check pH / pH management; levelling / raking / harrowing; raising soil for seed bed / drainage; irrigation of soil; drainage; allow fallow period;	**4**

Question	Answer	Marks
10(b)	*1 mark for naming a hand tool and 1 mark for naming a mechanised tool used to prepare soil for cultivation.* *Must have one hand tool and one mechanised tool for full marks plus address additional maintenance for stony ground and wet soils, for example:* *hand tool:* hoe; mattock; seeder / seed bag; fertiliser spreader; spade; fork; rake; *mechanised cultivation tool:* (mouldboard) plough; tractor; cultivator; harrow; seeder; fertiliser spreader / muck spreader; sprayer; irrigator; *3 further marks available for maintenance actions relating to either stony ground or wet soils, for example:* *stony ground:* check / tighten nuts / bolts; check / adjust tyre pressure; mend punctures; sharpen tines; replace missing tines / broken parts / straighten bent parts; check / reset linkages / pins;	**5**

Question	Answer	Marks
10(b)	*wet soils:* wash / clean / remove soil / mud; paint; grease / oil / lubricate; treat with anti-rusting agent; dry / keep in dry conditions; clear blockages;	
10(c)	purchase cost of tractor / interest / borrowing costs; horsepower / size of implements to be used; speed of task completion (tasks are completed faster, e.g. planting is quicker); reliability (tractor is less likely to be unavailable / does not get ill); veterinary bills; maintenance costs of tractor; income from ox sale; ability to cultivate a piece of land without mechanisation; labour costs; need for trained tractor operators; area to cultivate; risk of damage to soil from tractor; depreciation on tractor; age of ox; spare parts may be difficult to obtain; keeping cattle may provide other products, e.g. milk; the ox produces manure which can be used as fertiliser; running cost high / tractor is expensive to run; fuel / oil can pollute the environment / need careful / specialist disposal; topography may not allow the use of machinery;	**6**

Question	Answer	Marks
11(a)	*1 mark for pest and 3 marks for effects.* *Accept any named boring pest, e.g.* weevil / stalk borer / American bollworm; *effects:* plant destroyed / plant dies; weakens plant / plant falls down / plants lodge; plant tissue eaten / damaged / stem holes are made / vessels are damaged; fruit damaged; leaves removed / holes in leaf / reduced leaf area for photosynthesis; flower buds fall off; reduced growth rate / yield; water is lost from the plant / wilting; reduced transport of nutrients; transfer of pathogens / disease from one plant to another;	**4**

Question	Answer	Marks
11(b)	biological control / control using a natural enemy / predator; which feeds on / destroys pest / reduces pest population; example of biological control; use of sterile males to restrict breeding success; pheromone traps to attract and kill pest; use of bacteria / virus / nematodes / parasite / pathogens to kill pest; use crop rotation to break life cycle of pest; burning to kill pest; remove residue / field trash; ploughing to expose eggs or larvae; weeding / plant alternative crops to remove pest host; use clean / certified planting material / resistant varieties to remove pest burden; plant nursery crops to enable more robust seedlings to be transplanted; time planting / harvest to avoid pest build up; nets / traps / hand picking / washing to remove pests; methods to scare pests away / keep them off the crop; strip planting / companion cropping to dissuade pests from crop; physical barriers, e.g. netting to prevent pest reaching crop; apply organic pesticide; method of application of pesticide / spraying / seed dressing / time of application / pre-emergent; *Any chemical methods need to specify organic pesticides.*	**5**

Question	Answer	Marks
11(c)	*Linked way and explanation for 2 marks. Maximum of 3 marks without explanation.* chemical drift; do not spray / apply chemicals on a windy day; killing beneficial insects / pollinators; do not spray / apply chemicals in the location of beneficial insects / spray / apply chemicals at the correct time of day; chemical run-off; do not spray / apply chemicals when rain is due; pollution of water / damage to aquatic life / fertilisers use can cause eutrophication; do not apply spray / add fertiliser near water / do not wash the sprayer / applicator in a stream / water course; damage to habitats; do not spray / apply chemicals near hedgerows / other habitats; toxicity in the environment / food chain(s); use correct dilution of chemicals; contamination of environment; safe disposal of containers / gloves / mask / clothes; overuse of chemical / number of applications to effectively control pests; monitor / count / predict pest number and apply accordingly / in moderation / at correct application rate; harm to non-target species / the crop itself; use selective / non-toxic chemicals / do not spray / apply chemicals near other plants;	**6**

Question	Answer	Marks
12(a)	*1 mark for meaning of phenotype.* *phenotype meaning:* physical expression (of a gene) / physical appearance; *phenotypes expected:* body is of large size / high mass / weight; (body has) a muscular conformation; carcase produces marbled meat; meat has a high lean to fat ratio / animal's body is lean; animal is fast growing; animal is fast finishing; animal has a high food conversion ratio; may not have other features, e.g. horns, (which waste resources); disease resistance;	**4**
12(b)	animals with desired traits / best animals are selected; these animals are crossed with each other; restrict breeding of animals without the desired trait; offspring animals are produced; further selection from offspring for the desired trait; continue over a number of generations; example of trait, e.g. growth rate, conformation, disease resistance;	**5**

Question	Answer	Marks
12(c)	*Disadvantage and linked explanation for 2 marks. Maximum of 3 marks without explanation.* (high) cost; some semen / equipment is very expensive / could be more expensive than keeping own male animal; delays from desired mating time; need to catch / isolate animal / distance inseminator needs to travel; may not be able to obtain the desired semen; high-quality semen may not be available locally; may settle for lesser quality semen; so as not to miss service period; low conception rates; incorrect insemination / incorrectly placed semen / some females become pregnant more easily by natural service / operators may not be sufficiently skilled; risk of (internal) injury / infection to female animals / male animals during semen collection; poorly trained inseminators / incorrect use of equipment / failure to sterilise equipment;	**6**

Question	Answer	Marks
13(a)	plants making their own food; synthesis of carbohydrates / glucose / sugar; requires (sun)light; includes the production of oxygen; uses carbon dioxide; uses water; requires chlorophyll / chloroplast; takes place in leaves / spongy / palisade mesophyll cells;	**4**

Question	Answer	Marks
13(b)	*Maximum of 3 marks for each example.* transpiration; moves water / dissolved minerals; through the xylem; adhesion / tension / cohesion; transpiration 'pull'; diffusion; minerals / nutrients; soluble / dissolved; high to low concentration / down concentration gradient; osmosis; moves water; from cell to cell; down water concentration / water potential gradient; not active transport; translocation; synthesised food / sugar / sucrose / amino acids; moved as soluble substances; in the phloem / vascular tissues; by active transport; *Accept other appropriate examples.*	**6**

Question	Answer	Marks
13(c)	soil acidity; soil salinity; some crops do not grow; beneficial microbes die; (fertiliser) run-off; pollution of groundwater / contamination of water supplies; eutrophication; damage to aquatic life; overgrowth of plant foliage / underdeveloped roots / plant instability; excessive foliage attracts pests; (over)growth of weeds; root burn; (fertiliser) wastage; (chemical) soil pan;	**5**

Question	Answer	Marks
14(a)	*Maximum of 2 marks for each storage method, for example:* dam; dam wall thicker at the bottom / where pressure is higher; flowing water / river is blocked; water accumulates; water tank; stored up high to increase pressure; enclosed to prevent contamination; filled by rain water / mains supply / pumped water from groundwater source; reservoir / pond / lake; filled by rainwater / spring / river; constructed to hold a large volume of water / deep / large area;	**4**

Question	Answer	Marks
14(b)	*Maximum of 3 marks for each example.* human consumption; water from a mains / piped supply; filtered / treated water; chlorinated; consistent pressure / availability; expensive; irrigation / watering; water from roof / rainwater collection; water from pond / lake / reservoir / river / dam; lower cost; supply can be intermittent; may need to filter / remove debris / contaminants / toxins / should not contain pathogens; animal consumption; supply must be constant; water from roof / rainwater collection; water from pond / lake / reservoir / river / dam; supply must be disease- / parasite- / (dangerous) contaminant- / toxin-free / treated, e.g. chlorine / UV / irradiate / boil etc.; supply must be potable / not smelly; filtered / supply must be free of solids; for cooling, e.g. milk; any water source; water does not need to be treated; water can be reused; *Accept other appropriate sources of water for specific relevant purposes.*	**6**

Question	Answer	Marks
14(c)	*2 marks for animal health problems and 3 further marks for linked explanations.* poisoning / toxic shock; test water so toxin present is known; remove toxins / treat with chemicals so toxins are no longer dangerous / to bind toxins; injury / physical damage; pick out large contaminants, e.g. plastic bags / tree branches so they do not cause injury; use a filter to remove physical contaminants so they are not taken in by animals; allow water to settle in tanks before drinking, so debris can be removed / water used is debris free; parasites; test water so the parasite(s) present are identified; filter so parasites are removed; add chemical so parasites are killed; disease / illness / infection; treat with chlorine / anti-microbial agent so that pathogens are killed; heat so that the water is pasteurised / so that microbes are killed / enzymes are denatured; *Accept other valid health problems and allow any relevant linked explanations.*	**5**