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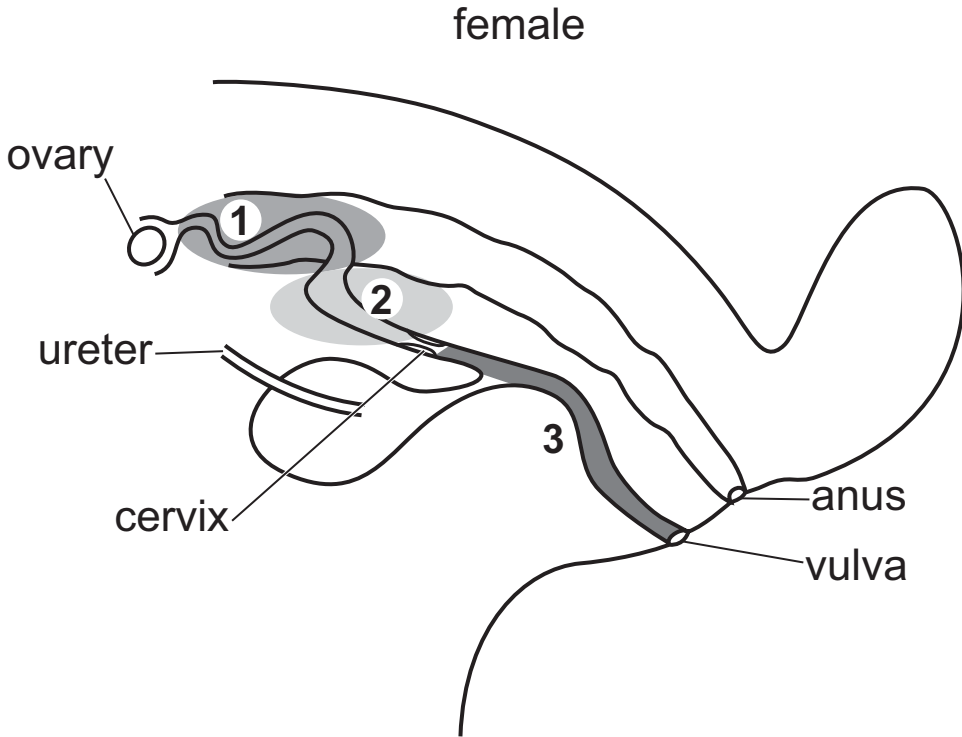
Question	Answer	Marks
1(a)(i)	screen protects the pump / removes or filters out large objects, e.g. debris / sticks / stones / leaves / dead birds / fish / branches;	1
1(a)(ii)	<i>water at C is / has:</i> lighter in colour / clearer; smaller particles; less suspended material, e.g. soil / mud in water; water no longer smells; <i>ORA for water at A.</i>	1
1(a)(iii)	to remove smaller objects / less dense (soil) particles at C that remain in suspension; which cannot pass through / are removed by the filter at C; to remove clay particles;	2
1(a)(iv)	particles too close together / impermeable; water could not pass through / clay is waterproof; clay particles are small; would make the water cloudy;	2
1(a)(v)	to kill bacteria / pathogens / microbes;	1
1(b)	to raise water to the storage tank; higher than tank D / because the storage tank is higher than the other tanks; the pump increases the force / provides pressure / does work to lift the water; against gravity;	2

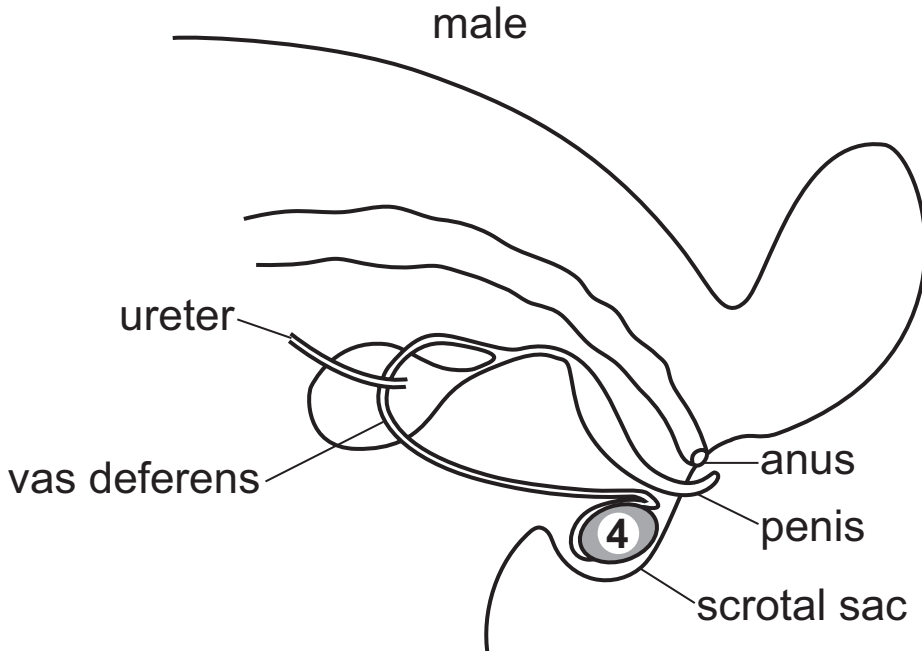
Question	Answer	Marks
2(a)	<i>Max. 2 marks for clearing or preparing alone.</i> <i>clearing:</i> felling / cut down trees / ringbarking; tree removal; ground / bush clearing / use of herbicides / remove weeds; stumping / remove roots; burning; use of pigs / goats; <i>preparing:</i> cultivation; plough / dig / turn over soil; disc / rake; create seedbed; drain; add lime if required; add fertiliser if required; add pesticide if required;	3
2(b)	erosion; desertification; evaporation; run-off / loss of organic matter; leaching / loss of soil fertility / nutrient loss; acidic soil; soil capping / panning; loss of soil organisms;	2

Question	Answer	Marks
2(c)	<i>Credit each explanation to answers in (b). One mark per explanation. Accept other valid explanations.</i> <i>For example:</i> <i>erosion:</i> terracing / plant vegetation / mulching with plant remains / plough across or not down slope / crop rotation / drainage prevents soil being carried away; <i>run-off / loss of organic matter:</i> drainage / bunds / terracing prevent rapid flow of water directly downhill; leaching / loss of soil fertility / nutrient loss prevent soil or water flowing away, which takes dissolved nutrients; <i>acidic soil:</i> liming to raise pH / do not overgraze or over fertilise reduces hydrogen ion build up / raises pH; <i>soil capping / panning:</i> mulching / minimum cultivation / use low soil-impact machinery protects soil surface from rain / keeps soil particles separate / prevents them clumping together / maintains porosity of soil;	2

Question	Answer	Marks
3(a)	named root crop; appropriate product / use;	2
3(b)	<i>preparation of seed-bed:</i> create fine tilth / remove lumps / crush / levelling / lumps / treading / rolling / raking / apply herbicide / apply pesticide / apply fertiliser / apply lime / digging / ploughing / turn the soil / use cultivating equipment; <i>sowing or planting:</i> sowing method / drills / holes / pockets / ridging / earthing up / label rows / water / use of mulch / use of fertiliser / manure; <i>growing stage:</i> use of fertiliser / manure / remove / prevent / growth of weeds / control pests / monitor for disease / treat disease; <i>storage of harvested crop:</i> <i>Any two of:</i> remove water / keep dry / keep covered; lower temperature / keep cold; store away from light / in dark; maintain correct atmosphere / well ventilated; example of storage container, e.g. silo / sack; clean the storage area; clear space in storage area; kill / prevent access of vermin / keep pest-free; chemical treatment of crop, e.g. fungicide / drying agent / anti-sprouting agent; <i>Accept application of fertiliser / manure / lime / pesticide once at an appropriate stage.</i>	5

Question	Answer	Marks
4(a)	more food; health, e.g. parasite burden; better quality feed / access to better pasture; genetic factors / breed; ewe / mother's characteristics; ewe milk quality / access to colostrum; gut efficiency;	2
4(b)	select sheep with high / best growth rates; use these sheep to produce offspring / next generation with higher growth rates;	2
4(c)(i)	source of fluid; high protein / vitamins / minerals or named vitamin / mineral / contains electrolytes; reduces scouring; improves feeding efficiency; contains / provides antibodies against disease; confers immunity / resistance to diseases (animal born without immunity); provides a source of energy; clears animal's bowel / laxative; highly digestible;	2
4(c)(ii)	the time at which young animals start to take solid food / infant gets used to food other than mother's milk / no longer rely on mother for feeding;	1

Question	Answer	Marks
5(a)(i)	<i>One mark for a correct location of each organ, example of acceptable zones shown for responses within 'tube' areas:</i> 1 for oviduct; 2 for uterus; 3 for vagina;  The diagram shows a sagittal cross-section of the female pelvic region. The word 'female' is written at the top. The reproductive organs are outlined. Three specific areas are highlighted with grey shading and numbered: '1' is on the oviduct (fallopian tube) near the ovary; '2' is in the uterus; '3' is in the vagina. Other labeled parts include the ovary, ureter, cervix, anus, and vulva. Lines connect the labels to their respective parts.	4

Question	Answer	Marks
5(a)(i)	4 for testicle; 	
5(a)(ii)	egg / ovum / oestrogen / progesterone;	1
5(b)(i)	testicle;	1
5(b)(ii)	thick walls control access; secretes mucus (into the vagina); small opening softens to allow sperm through at mating / expel foetus at birth; during pregnancy is filled with thick mucus / secretion / cervical 'plug' / helps retain embryo during gestation; protects uterus from infection; <i>Accept reference to specific pig example – spiral grooves grip penis / penis locking.</i>	1

Question	Answer	Marks
5(c)	sperm head enters egg; tail is lost / head enters; egg becomes impermeable; fusion of male and female gamete; zygote forms; diploid cell produced;	3
5(d)	age / genetic predisposition / infertility (male or female) / low sperm count / miscarriage / poor egg implantation / nutrition / timing of service / inefficient service / hormone imbalance in females / the egg has not been fertilised; <i>Accept other valid suggestions.</i>	1

Question	Answer	Marks
6(a)(i)	<i>One mark for the answer. One mark for a correct unit.</i> 1.67; t per ha; <i>Full marks for correct answer with units and to 2 d.p.</i>	2
6(a)(ii)	farm C; it has the lowest yield per hectare;	2
6(b)	<i>Award marks for descriptions of transmission via:</i> soil; seed; wind; insects / pests; water; weeds; plant-to-plant;	2

Question	Answer	Marks
7(a)	28.5; 20.6; 7.9; <i>Accept ECF for profit for candidate's total value of output minus candidate's total costs. If a loss results a negative value must be shown for the mark.</i>	3
7(b)	vet / medicine; labour; repair of buildings; additional equipment, e.g. ventilator; transport; utilities, e.g. gas; electricity; water; oil; <i>(Allow 2 named examples of utilities.)</i>	2
7(c)	disease control / vaccination; parasite control, e.g. worming / drenching; avoid overstocking; regular health checks; wean at the right time / not too early; good nutrition; chosen breed suited to environment; suitable environment, e.g. ventilation if indoors; good hygiene; clean water availability; isolate sick livestock; control predators; vaccinate; <i>Accept good stockmanship if no examples of this given.</i>	2

Question	Answer	Marks
8(a)	the appearance / features of an organism (resulting from inherited information / genes);	1
8(b)(i)	parents Hh x Hh; gametes H h x H h; offspring HH Hh Hh hh; <i>Allow ECF for a correct answer matching to incorrect parents or gametes.</i>	3
8(b)(ii)	C;	1
8(c)	<i>Examples may include:</i> <i>advantage:</i> success in attracting mate / fighting off rivals / fight off predators / knock down food / fences to access food / easier for farmers to catch; <i>disadvantage:</i> horns can be dangerous / get stuck in fences / hedges / damage to meat / skin from fighting / wound linked to horn could lead to infection / reduces number of animals that can be kept in an area / reduces number of animals that can be transported at one time / knock down farm fences;	2

Question	Answer	Marks
9(a)(i)	P; lowest number of grazing animals per hectare / ha; OR largest number of hectares / ha per grazing animal;	2
9(a)(ii)	correct pH levels; correct nutrient levels; improve drainage; add fertiliser; control pests; grow better types of grass / herbage; rotational grazing; management to avoid overgrazing, e.g. strip grazing; zero grazing; animals individually tethered; sow with legumes; irrigate;	2
9(b)	forage / grass is cut / chopped; conserved for later use; food transported to the livestock / pen / shed where the livestock are housed; animals are kept indoors / in yards; animals are fed by farmer;	2
9(c)	overgrazing; preferred plants die out; animals receive poor diet; erosion; loss of soil nutrients; soil structure damaged, e.g. compaction / soil cap / soil pan; soil acidification; disease, e.g. increased pest / parasite burden; lower growth rates / longer time to finish animals; animal stress; pasture destruction / exhaustion;	3

Question	Answer	Marks
10(a)	minimum amount of food required to keep an animal healthy / alive; animal stays in initial condition / no production / no gain or loss in mass / work done; important for maintaining stock when there is a feed shortage, e.g. during drought;	2
10(b)	<i>ruminant:</i> teeth are adapted for grinding; allows regurgitation of the cud; has multiple chambers in stomach / stomach has four regions; rumen; reticulum; omasum; abomasum / true stomach; <i>non-ruminant:</i> has longer large intestine; the premolars and molars are smaller; birds have no teeth; the stomach has one region / simple stomach; the volume of the stomach is relatively large; cannot regurgitate and re-chew / chew cud; some have larger caecum;	5

Question	Answer	Marks
10(c)	<i>One mark for naming a non-ruminant. One mark for a function of each part.</i> <i>named non-ruminant;</i> <i>mouth / teeth / beak:</i> collection / pecking of food; food moistened by saliva; action of salivary enzymes; masticated / chewed by teeth; <i>oesophagus:</i> swallowing; passage of food / peristalsis; <i>stomach:</i> food mixed with gastric juices; churning; action of stomach acid; <i>small intestine (duodenum / ileum):</i> receives semi-liquid output of stomach; alkali added to increase pH; bile / pancreatic juice added (from liver / gall bladder or pancreas); bile emulsifies fats / oils; enzyme action; nutrient absorption; <i>large intestine / colon:</i> bacterial action; water absorption; transports waste into rectum; <i>rectum:</i> stores waste material / secretions / bacteria; passed out / egested;	8

Question	Answer	Marks
11(a)	air is 78% nitrogen; cannot be directly absorbed by plants; movement of N through environment; nitrogen fixation; by bacteria / rhizobium; root nodules; action of lightning; nitrogen from decay of organic material / dung / urine; produces ammonium compounds / ammonification; action of nitrifying bacteria / nitrification; production of nitrites and then nitrates; nitrate absorption by plants; nitrogen used for protein production; animals consume plant material; action of denitrifying bacteria / denitrification;	5
11(b)	more than one (major) nutrient per addition; can provide known / targeted nutrients; consistent amounts / application; can be slow release; different compounds for different crops / fields; by increasing the NPK levels of the soil as needed; risk of soil acidity; reduction in soil microbes; some may add no organic matter, qualified; soil structure may deteriorate;	4

Question	Answer	Marks
11(c)	<i>Max. 4 marks for legumes or organic fertilisers alone.</i> <i>legumes:</i> root nodules of legumes can fix nitrogen not available to plants; this is carried out by nitrogen-fixing bacteria / Rhizobium; plant decays releasing N into soil; nitrogen is incorporated into soil; avoids nutrient depletion; <i>organic fertilisers:</i> provide nitrogen (also P and K depending upon source); contain trace minerals; can improve soil crumb structure; can add humus which improves soil structure; can improve drainage or water retention dependent on soil type; can improve mineral retention; reduces soil erosion; some add organic matter or bulk to the soil;	6

Question	Answer	Marks
12(a)	<i>One mark for naming a biting and chewing crop pest.</i> e.g. (grass)hoppers / locusts / termites / leaf miners / beetles; crop destroyed / eaten; crop may fall down; leaves / stems removed; loss of photosynthetic tissue; less sugar / carbohydrate made; less growth / lower yield; wilt / water loss; site of disease entry;	4
12(b)	<i>cultural / mechanical methods:</i> crop rotation; early planting; collect by hand / pick off; use nets to protect; reduce breeding sites / remove trash and field waste; burning; companion planting; planting a crop which is toxic to the pest; use resistant varieties; sticky traps; <i>biological methods:</i> introduce a predator; example of predator and prey; eats / preys on / kills pest; sterile males; pheromone traps;	5

Question	Answer	Marks
12(c)	<i>inputs lowered:</i> reduced costs; less fertiliser needed; less herbicide needed; less pesticide use; resistance to pests, weeds and / or disease; use of machinery / labour / fuel costs lower; thrive in poor soil or adverse climates; <i>outputs increased:</i> more income / profit; may produce more desirable product; more to sell / bulk production; quickly to market when demand is high; less waste; crops can be more productive / have a larger yield / bigger fruit; faster growth rate; foods stay fresh / ripe for longer so they can be shipped long distances to more markets; longer shelf life; can have enhanced flavour / nutrient content; lower losses;	6

Question	Answer	Marks
13(a)	enables zero grazing; animal damage to ground reduced; maximise forage yield; increased forage quality; less risk of contaminated feed; controlled feeding; easier to mechanise feeding; easier animal management / husbandry; can manage different fields / areas differently;	6
13(b)	tank detail, e.g. up high; increase pressure; pipe systems / taps; ball valve; water bowl; trough; nipple drinker; connection detail, e.g. pipe joining;	3
13(c)	lack of the benefits of natural sunlight; named issue, e.g. vitamin D deficiency / ringworm; good hygiene is more difficult because animals are closer together; waste management issue created; building maintenance / usage cost; is more costly than keeping outdoors; feed cost increased due to increase use of brought in food; costs of transporting food; additional labour requirements, e.g. cleaning; cost of welfare regulations; pollution issues, e.g. smells; pollution in run-off; health issues; aggression / fighting / stress-related issues; higher disease risk; easier disease transmission between animals; negative impacts on animal's feet;	6

Question	Answer	Marks
14(a)	<i>Accept similar arguments if used in context of treatment on animals rather than plants.</i> <i>systemic pesticide:</i> accept an example of a systemic pesticide; can be sprayed anywhere on the plant; absorbed through the surfaces of leaves / stems / roots / seed; pesticide moves to other parts of the plant; carried internally to all parts through the phloem sap of plants; affects pests feeding on any part of a plant; pest ingests chemical; pest dies; <i>contact pesticide:</i> accept an example of a contact pesticide; have to reach their target directly, e.g. make contact with the pest; absorbed a short distance through the external body surface or exposed tissue of the pest; are not carried around inside the plant; must touch target pest to be effective / relies on contact rather than ingestion; a thorough application of a contact pesticide is more important than with a systemic pesticide; often less effective (often fails if the insect pest lives below leaves or in tight locations of the flower or nodes for example); less effective on pests with protective parts;	4

Question	Answer	Marks
14(b)	<i>Max. 3 marks for either storage or usage alone.</i> <i>storage:</i> not near food store; not near settlements; not near drains / water courses; not near flammable material; dry and cool room; well-ventilated room; fire-resistant door; security, e.g. locked away; warning signage; leakage retention; store powders above liquids; visible products / good lighting; <i>usage:</i> do not spray when windy; do not spray near water courses / on rainy day / allow to be washed away; do not use near food; no eating / drinking / smoking when using; safe disposal of containers / contaminated clothing after use; do not wash out sprayer in stream; maintain equipment; protective clothing / gloves / mask; correct dilution / mixing; operator should wash after use;	5

Question	Answer	Marks
14(c)	<i>Accept reverse arguments for chemical methods.</i> <i>advantages of biological methods:</i> cost effective as one application can control pests for an extended period; cost effective as less expensive equipment required; cost effective as less labour needed to apply; usage is not dependent on weather, do not have to wait for a suitable day to spray; if sufficiently targeted may have no effect on crops; tend to be pest specific, does not kill beneficial insects; crop is organic so may have higher value / desirability; safe for the user as toxic chemicals are not used / no side effects; safe for the consumer as toxic chemicals do not enter the food chain; <i>disadvantages of biological methods:</i> more labour needed for monitoring and identifying pests, increases costs; some biological control methods are costly, increased costs; some are not as effective on a field scale as in a controlled environment; may need multiple types of biological control methods for multiple pests; there may not be an effective biological control solution for some pests; need to control release time carefully, e.g. at correct point in life cycle; results may be slower to achieve; the use of biological methods limits the possible use of pesticides to control other pests; some biological control methods become damaging to the environment, e.g. introduce invasive species or damage other crops;	6