01. 0610_w19_MS_42 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	anthers / stamens / filaments / stigma, hang / AW, outside (the flower) ; large, anthers / **C**, produce large quantities of pollen ; *idea that* anthers / **C**, easily release pollen ; 'feathery' / AW, stigma / **B** ; stigma has, feathery surface / large surface area, to catch pollen ; bracts / **A**, are, small / inconspicuous ;	3	**A** petals
(a)(ii)	**C** ;	1	
(b)	*idea that* pollination / fertilisation, always going to happen / AW ; no agent of pollination needed ; little wastage of pollen ; reduced / little, variation / diversity ; increased competition between plants (as have the same adaptation) ; increase chance of, genetic / inherited, disease ; all plants adapted to same, conditions / environment ; little ability to adapt to changing conditions / little ability to evolve ; an infectious disease can kill all of the population / all plants more susceptible to the same disease ; risk of extinction ; AVP ;	4	
(c)	drought / lack of rain / lack of (irrigation) water ; flooding ; fire ; tsunamis / cyclones / hurricanes ; earthquakes / volcanic eruptions ; plagues of, animals / insect pests ; pests / diseases, of stored food / livestock ; conflict / war ; rising prices of food ; poverty ; unequal distribution of food ; growing, non-food crops / biomass for fuels / crops for export ; increase in population / migration of people ; soil degradation / soil erosion / desertification / salination of soils / loss of soil fertility / barren land / AW ;	3	
(d)(i)	expose the plants to (stem), rust / fungus ; find out if plants have DNA for rust resistance ; only use those plants that show no symptoms / AW ;	2	
(d)(ii)	to increase the, numbers of plants / population ; incorporate more genes from the high yield variety ; to maximise the yield of wheat from individual plants ; check that the plants keep their resistance to rust ; check the plants grow well in field conditions ; make sure the plants are, pure-breeding / homozygous ;	1	
(e)	*one from:* one, cotyledon / embryonic leaf / seed leaf oblong leaves / narrow leaves / straight leaves parallel-veined leaves / straight veins (named) flower parts in multiples of three fibrous roots / adventitious roots scattered vascular bundles in stem AVP ;	1	

02. 0610_s18_MS_42 Q: 3

	Answer	Mark	Partial Marks
(a)(i)	sucrose / sugar ; amino acids ;	2	
(a)(ii)	translocation ; (phloem) allows bidirectional movement / AW ; movement (of food / sap) from source to sink ; sucrose / amino acids / food, are produced / taken from storage, at a source ; region of respiration / storage / growth, is a sink ; named example of a, source / sink (in the correct context) ; some organs can be both a source or a sink at different times ;	4	
(b)	*functions* conduct / transport, water (and mineral ions) ; *ref to* transpiration ; reduced resistance to water flow / AW ; structural) support (for plant) ; prevents (inward) collapse (of xylem vessels) ; (spirals) allows (some) flexibility / bending, of stems (to prevent breaking) ; *adaptations* long / elongated (cells / vessels / tubes) ; *ref to* lignin (in walls) ; (cell walls) are water impermeable / waterproof / AW ; (secondary) thickening of cell walls ; hollow / no cytoplasm / no (named) organelles ; no, end / cross, walls (between cells) ; end plates to connect vessels (end to end) ; pits in walls (for water movement between vessels) ;	6	max 5 from one section **A** rings / spirals / AW
(c)	reduced / no, damage to crops ; **ora** increased, yield / quality (of the crop) ; **ora** more, income / profit ; **ora** because more, sugar / amino acids, available for growth ; **ora** reduced disease transmission / AW ; **ora**	2	**A** not / less, eaten by pests

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03. 0610_s17_MS_42 Q: 1

	Answer	Mark	Partial Marks
(a)(i)	yeast ;	1	**A** fungus / *Saccharomyces (cerevisiae)*/ *S. cerevisiae*
(a)(ii)	respiration / fermentation ;	1	
(b)(i)	**1** drought ; **2** flooding / tsunami / monsoon / hurricane / cyclone ; **3** earthquake ; **4** volcanic eruption ; **5** (named) disease ; **6** AVP ;	2	**MP 1 I** desertification **I** tornado / landslide (too localised) / acid rain (not natural) / loss of soil fertility (usually not natural) **I** fire e.g. potato blight / foot and mouth disease e.g. (locust / rat) plagues
(b)(ii)	**1** increased demand for food ; **2** unequal (global) distribution of food ; **3** war / poverty ; **4** limited land for farming / increased urbanisation / AW ; **5** cash crops ; **6** poor farming practice ; **7** pollution (linked to crop failure) ; **8** AVP ;	3	**A** (food) spoilage / wastage **A** government policies / sanctions **A** biofuels / tobacco (crops) e.g. loss soil fertility / erosion / eutrophication e.g. acid rain burning crops e.g. overfishing
(c)	**1** outbreaks / spreading, of diseases / pests / plagues ; **2** endangered / extinction, of species ; **3** disruption to food chains / described ; **4** loss in (variety) of, habitat / places where organisms live / described ; **5** loss of nutrients / disrupted nutrient cycling ; disrupted (soil) fertility **6** decreased in (soil) water / desertification ; **7** soil erosion / described ; **8** increased (described) pollution ; **9** deforestation ; **10** efficient food production so less land required ; **11** AVP ;	4	**A** loss of (bio)diversity **A** landslides / reduced soil volume e.g. targeted use of pesticides / AW

	Answer	Mark	Partial Marks
(a)(i)	72 (%) ;;	2	difference = 724 g m^{-2} $year^{-1}$ = 724 / 1009 □ 100
(a)(ii)	1 (fertiliser provides) nutrients / salts / ions / minerals (required by plants) ; 2 (nitrogen / nitrate) needed for making, amino acids / proteins / RNA / DNA / AW ; 3 proteins are used in growth ; 4 (magnesium for) making chlorophyll ; 5 (chlorophyll for) photosynthesis ; 6 AVP ;	3	**A** original soil lacked minerals
(a)(iii)	eutrophication ;	1	
(b)	1 fertiliser decreases species diversity ; 2 at 21 weeks the difference is greater (than other weeks) ; 3 species diversity increases and decreases ; 4 peak at 6 weeks ; 5 week 24 with fertiliser not following the trend / AW ; 6 any data quote including data for both plots with units ;	3	**I** anomaly **A** increases
(c)	1 some species compete much better than others / better at obtaining (named) resource(s) ; 2 competition for, light / water / nutrients / space / AW ; 3 some species grow faster ; 4 example of grassland, adaptions / fast growth ; 5 better at using ions released by fertiliser ; 6 more 'robust' / less successful at combating disease *or* pests ; 7 some cannot survive grazing by grassland herbivores / AW ; 8 ref to adaptations ;	2	**MP 2 I** competition for mates **MP 4** examples: taller stems / larger leaves / longer roots

05. 0610_s19_MS_42 Q: 2

<table>
<tr><th></th><th>Answer</th><th>Mark</th><th>Partial Marks</th></tr>
<tr><td>(a)</td><td>burning / use, (named) fuels ;
deforestation / AW ;
increased human population ;
example of named relevant human activity ;
AVP ;</td><td>3</td><td></td></tr>
<tr><td>(b)</td><td>description:
rate (of photosynthesis) peaks at, 12:00 / midday / noon ;
photosynthesis starts at, 06:00 / stops at, 20:00 / 8 pm ;
rate (of photosynthesis) at 550 (ppm) / AW, is greater than at, 370 (ppm) / AW ;
both plots / 550 and 370 ppm, follow same trend / pattern ;
comparative data quote between two plots with units at least once ;

explanation:
maximum light at 12:00 / dark until 6:00 / after, 20:00 / 8 pm ;
reference to light intensity as a limiting factor ;
because light is required for photosynthesis ;

reference to CO_2 as a limiting factor ;
(at high atmospheric CO_2) the concentration gradient (to air spaces) is steeper / diffusion is faster ;
effect of CO_2 concentration is most at high light intensities ; ora

reference to temperature as a limiting factor ;
higher temperature causes increased rate of photosynthesis ; ora
AVP ;</td><td>6</td><td></td></tr>
<tr><td>(c)</td><td>epidermis
<table><tr><th>feature</th><th>adaptation</th></tr><tr><td>transparent / clear / no chloroplasts</td><td>allows light to pass through ;</td></tr><tr><td>thin / flat</td><td>so less cytoplasm / more light, to pass through / AW ;</td></tr><tr><td>guard cells / stomata</td><td>allow gases to enter / leave the leaf / gas exchange ;</td></tr></table>
mesophyll
<table><tr><th>feature</th><th>adaptation</th></tr><tr><td>contains many chloroplasts (palisade)</td><td>trapping light energy ;</td></tr><tr><td>vertically / tightly, packed / column-shaped (palisade)</td><td>maximise light received (by cells) / reduce number of, cross / cell, walls ;</td></tr><tr><td>contain (air) spaces / loosely packed (spongy)</td><td>for diffusion / movement of gases (within leaf) ;</td></tr></table></td><td>4</td><td>one mark per row, max two from each tissue</td></tr>
<tr><td>(d)</td><td>more carbon dioxide in the blood ;
low pH / acid, in blood ;
(high) carbon dioxide detected by brain ;
increases impulses to (named) muscles used in breathing / AW ;
correct reference to negative feedback / homeostasis ;</td><td>2</td><td></td></tr>
</table>

06. 0610_m17_MS_42 Q: 4

	Answer	Mark	Partial Marks
(a)	carbon dioxide ; light energy ; chlorophyll ;	2	
(b)	(2 ÷ 13) × 100 ; 15(%) ;	2	
(c)(i)	increased rate of transpiration ; greater concentration of water vapour inside the leaf than outside ; more water vapour diffuses out of the leaf ; through stomata ; more water is drawn up through xylem / transpiration pull ;	3	
(c)(ii)	by osmosis ; the soil has a higher water potential than the root cells ; water moves from an area of higher water potential to lower water potential ; across a partially permeable membrane ; ref to root hair cell ;	3	**A** down a water potential gradient
(d)	**1** loss of habitat ; **2** population decrease / migration ; **3** extinction / endangerment, of species ; **4** loss of biodiversity ; **5** less food ; **6** disruption of, food chains / food webs ;	4	

07. 0610_s20_MS_42 Q: 4

(a)	to increase crop, yield / production ; to reduce competition with weeds ; AVP ;	2
(b)(i)	concentration of both herbicides decreased (with time) / described ; **A** higher concentration than **B** (throughout) ; **B** reached zero concentration before **A** ; comparative data quote with units stated ; **A** steeper than **B** initially ;	3
(b)(ii)	kills, water plants / algae ; lack of, producers / food for herbivores ; bioaccumulation / described ; reduced biodiversity ; (lack of roots causes) erosion / silting / flooding ; AVP ;;	4
(c)(i)	network / branched, veins ; broad (leaves) ; petiole ; AVP ;	2
(c)(ii)	auxin ;	1
(c)(iii)	*any three from:* no chlorophyll synthesis ; cannot trap sunlight ; cannot photosynthesise ; AVP ;	3

08. 0610_s20_MS_43 Q: 6

(a)	*any three from:* if crops are used as food for humans fewer trophic levels in the food chain ; energy lost at each trophic level in the food chain ; 90% energy lost / only 10% energy passed on ; energy is lost from the cattle ; any two examples of energy loss from cattle ;; therefore less energy available to humans ; AVP ;	**3**
(b)	*any four from:* smell / visual pollution ; increase risk of water-borne disease ; increase organic content of, rivers / lakes ; increase growth of, bacteria / decomposers ; bacteria / decomposers, use up dissolved oxygen ; death of (named) organisms that rely on dissolved oxygen ; eutrophication ; adds, urea / ammonia ; increases plant growth ; AVP ;;	**4**
(c)	*any three from:* lack of food supply / unequal distribution of food ; wars / sudden immigration, with inadequate resources for the population ; drought / floods, destroy crops / kill livestock ; disease in, food plants / animals ; poverty ; AVP ;;	**3**

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09. 0610_m19_MS_42 Q: 4

	Answer	Mark	Partial Marks
(a)	pollutant / source / effect on environment sulfur dioxide ; / (burning) fossil fuels ; / acid rain carbon dioxide / (burning fossil) fuels ; / enhanced greenhouse effect methane ; / cattle and rice farming / enhanced greenhouse effect fertilisers / arable agriculture / eutrophication	**4**	
(b)(i)	(named) fertiliser leached into, rivers / streams / lakes ; producer growth / algal bloom / algae growth / plant growth ; death of producers ; increased decomposition / increased decomposers ; increased respiration (aerobic) ; decomposers use up the oxygen in the water ; organisms / fish / creatures, die / suffocate / migrate, due to lack of oxygen ; AVP ;	**6**	
(b)(ii)	use, less / correct amount, of fertiliser / calculate how much fertiliser is needed ; use slow-release fertilisers ; do not apply, during / after, rain / when rain is forecast / limit watering ; do not use near water / make channels between land and water body ; only apply when crops, will take-up fertiliser / are growing ; **ora**	**2**	

	Answer	Mark	Partial Marks
(a)(i)	1.2 □ 10^8 (g) / 120 000 000 (g) / 1.2 □ 10^5 (kg) / 120 000 (kg) ;; kg or g (per day) ;	3	
(a)(ii)	avoid too much (named) sugar in diet ; flossing ; regular visits to, dentist / hygienist / AW ; AVP ;	1	
(b)(i)	diatom (→) lugwom (→) (wading) bird ; arrows in correct direction ;	2	
(b)(ii)	*description:* more ammonium ions remain in bucket / less ammonium, absorbed (by diatoms) ; less faeces ; higher respiration rates ; lower body mass ; *explanation:* less, diatoms / food / ammonium ions, for lugworms ; (high respiration of lugworms) to, release more energy / for finding food / stress etc. ; slower growth rate of (lugworms) ; (non-biodegradable) microplastics (negatively) affect digestion ;	4	
(c)(i)	protein / urea / amino acid ;	1	
(c)(ii)	nitrification ;	1	
(c)(iii)	plants absorb (nitrogen as) nitrate (ions) ; needed to make, amino acids / (named) proteins ; to make DNA / RNA / nucleotides / bases ; protein / DNA, is needed for, growth / cell division / mitosis ;	3	
(d)	visual pollution ; chokes / strangles / traps / blocks digestive systems / AW (of animals) ; *reference to*, chemical exposure / fumes / toxins ; (plastic) accumulates in an organism / is passed down a food chain ; (described) habitat destruction ; e.g. plastic covers the habitats (plastic) blocks (light / water for) photosynthesis (for land plants) ; (plastic) block roots / prevents root growth ; remain in the ecosystem (for a very long time) ; AVP ;	5	

11. 0610_w19_MS_42 Q: 6

	Answer	Mark	Partial Marks
(a)	<table><tr><th>letter on Fig. 6.1</th><th>name of the process in the carbon cycle</th></tr><tr><td>A</td><td>photosynthesis ;</td></tr><tr><td>B</td><td>combustion ;</td></tr><tr><td>C</td><td>respiration ;</td></tr><tr><td>D</td><td>fossilisation ;</td></tr></table>	4	
(b)	*gap 1:* heat OR long-wave / infra-red, radiation ; *gaps 2 and 3, any two from:* ;; paddy fields / rice farming (named) animals / livestock decay / decomposition (by bacteria) rubbish tips / landfill sewage / dung / faeces (natural) gas extraction / fracking melting tundra waterlogged soil / swamp / marsh biomass burning / forest fires / peat fires *gap 4:* enhanced ; *gap 5:* sulfur dioxide / sulfur trioxide / nitrogen oxide(s) ; *gap 6:* non-biodegradable / micro- / non-recyclable / single-use ;	6	

12. 0610_s17_MS_42 Q: 5

	Answer	Mark	Partial Marks
(a)	**1** lake / river, pH decreases / acidification ; AW **2** aluminium ions become mobile ; **3** nutrients / named example(s), leached ; **4** shells damaged ; **5** fish / frogs, fail to reproduce ; **6** (aquatic) plants, die / become damaged / AW (from acid) ; **7** disrupts food chains / described ; **8** loss of (bio)diversity / endangered / extinct, species ; **9** acid / low pH / aluminium ions, toxic to / kills / AW, aquatic animals ; **10** fish produce mucus which blocks gills ; **11** AVP ;	5	**ecf** on 'higher pH' **MP 3** e.g. potassium / calcium / unqualified ions **MP 6 / 9 A** kills aquatic organisms = 1 mark **MP 6 I** plant death via eutrophication **MP 9 I** low oxygen causes fish death e.g. denatured enzymes / described loss of habitat in context
(b)(i)	(acid rain often caused by) sulfur dioxide / sulfuric / sulfurous acid ; chlorine / hydrochloric acid, does not cause acid rain ;	1	**I** sulfur unqualified
(b)(ii)	pH, meter / paper / probe / sensor / AW ; (pH) indicator ;	1	**I** data logger unqualified **A** named indicator
(b)(iii)	warmth ; oxygen ; water / moisture ; AVP ;	2	**A** heat / temperature **A** humidity e.g. conditions that break dormancy of pine seeds: low pH, cold, light qualified, stratification described
(c)(i)	(aerobic) respiration / fermentation / metabolic reactions ; heat / energy, is released ;	2	**MP 1 A** (named metabolic reaction) e.g. hydrolysis / enzyme activity **A** exothermic reaction / heat produced **I** produce energy unqualified
(c)(ii)	denatures enzymes ;	1	
(c)(iii)	germination / temperature, increased as, pH increased / acidity decreased ; **ora** no / little, effect / AW, at less than pH 4 ; **ora** comparative data quote between pH and temperature with units stated at least once ;	2	**I** ref to pH 7.0 as optimum
(d)	(Petri dish) **2** / pH 3.5 ;	1	

13. 0610_m16_MS_42 Q: 4

<table>
<tr><th></th><th>Answer</th><th>Mark</th><th>Partial Marks</th></tr>
<tr><td>(a)</td><td>1 overall carbon dioxide concentration increases ;
2 at a steady rate ;
3 there are minor fluctuations in carbon dioxide concentration ;
4 the fluctuations occur, regularly / yearly / seasonally ;
5 use of comparative figures with year and concentration with units ;</td><td>[max 3]</td><td>A gradual I constant</td></tr>
<tr><td>(b) (i)</td><td>methane ;</td><td>[1]</td><td>I carbon dioxide / carbon monoxide / water unqualified.
A other correct greenhouse gases</td></tr>
<tr><td>(ii)</td><td>1 radiation / light from the Sun hits, Earth / atmosphere ;
2 (named) short-wave radiation passes through carbon dioxide layer ;
3 re-radiated / reflected, from the ground as long-wave radiation / infrared / heat energy ;
4 long-wave radiation / infrared / heat energy, trapped / prevented from escaping from atmosphere by carbon dioxide ;</td><td>[max 3]</td><td>I climate change

mpt 3 A re-emitted</td></tr>
<tr><td>(c)</td><td><table>
<tr><td>mineral ion</td><td>function in plants</td><td>effect of ion deficiency on plants</td></tr>
<tr><td>nitrate</td><td>make amino acids / proteins / DNA / RNA / enzymes / chlorophyll ;</td><td>poor growth / lower leaves die early ;</td></tr>
<tr><td>magnesium</td><td>used to make chlorophyll / pigments ;</td><td>yellow leaves / chlorosis ;</td></tr>
<tr><td>phosphate</td><td>used for making DNA</td><td>poor root growth</td></tr>
</table></td><td>[4]</td><td>I reference to yields

I chloroplasts</td></tr>
<tr><td>(d)</td><td>1 fertiliser / nutrients, leached into / enter, rivers / streams / lakes ;
2 causing algal bloom / algae growth ;
3 algae block sunlight from entering water ;
4 so rooted plants unable to photosynthesise ;
5 so plants die ;
6 bacteria, decompose / feed, on dead plants ;
7 so bacterial population increase ;
8 bacteria respire aerobically ;
9 bacteria use up the oxygen in the water ;
10 organisms / fish / creatures, die / suffocate / migrate, due to lack of oxygen ;</td><td>[max 6]</td><td>A decomposers for bacteria
R if incorrect reason
I bacteria breed unqualified</td></tr>
<tr><td></td><td></td><td>[Total: 17]</td><td></td></tr>
</table>

14. 0610_s16_MS_42 Q: 5

	Answer	Mark	Partial Marks
(a) (i)	testes ;	[1]	**A** adrenal gland / ovaries
(ii)	increases, muscle mass / strength / power ; improved recovery of muscle damage / promotes protein synthesis ; increase, competitive drive / aggression / AW ; increases bone, density / mass ;	[max 1]	
(iii)	maintains, uterine lining / endometrium ; inhibits, FSH / LH (release) ;	[max 1]	**R** uterus wall. **I** thickens lining
(iv)	oestrogen ;	[1]	
(b)	***A** is most polluted because:* greater (overall) concentration of hormones ; all hormones at higher concentration except oestrogen ; comparative data quote with units ; (but) similar levels of oestrogen / (natural) progesterone (to **B**) ; ***B** is most polluted because* more oestrogen (than **A**) ; more types of hormones ;	[max 3]	
(c) (i)	*Lake **B*** oestrogen decreases (slightly) ; progesterone / testosterone, increases (slightly) ; *Lake **A** or Lake **B*** no / little, effect on oestrogen / progesterone / testosterone without ozone; *Lake **A*** chlorine with ozone caused, decrease in testosterone / synthetic progesterone / increase in natural progesterone ;	[max 2]	**A** mp 1, 2, 4 as data quotes **R** little effect on testosterone with ozone
(ii)	make the water safe, to return to the environment / for human use ; kill, pathogens / (harmful) microorganisms / bacteria ;	[1]	**I** germs **A** disinfectant / sterilisation
(d)	 eutrophication ; (aquatic) plants, die / cannot photosynthesise (due to blocked light) algae / (aquatic) plants / organic material, decayed by bacteria ; (aerobic) respiration (by bacteria / decomposers) ; decreased pH / increased acidity (due to low oxygen) ; oxygen concentration decreases (due to bacteria / decomposers) ; (aquatic) animals / fish, migrate / die, due to lack of oxygen ; disrupted / altered, (aquatic) food chains / habitats ; more, flies / mosquitoes ; (more) waterborne (named) disease ; e.g. cholera / typhoid smelly / visual pollution ; toxicity / mutations caused, by heavy metals / sewage ; (female contraceptive) hormones cause feminisation of (aquatic) organisms ; (female contraceptive) hormones cause reduced sperm count (in aquatic animals) ;	[max 6]	**I** marine and other non-lake ecosystems **I** unqualified death / extinction throughout **A** growth of, floating aquatic plants / algae / algal bloom **A** nutrients in sewage as organic material **A** microorganisms / decomposers for bacteria **I** all oxygen used up **A** diseases / pathogen in humans or aquatic organisms **A** biomagnification / bioaccumulation / death of (aquatic) organisms by, heavy metals / toxins / poisons, in sewage **A** hormone may cause gender change in fish
		[Total : 16]	

(a)	*any two from:* *assume features are of protoctists unless told otherwise* nucleus / nuclear membrane / nuclear envelope ; (named) organelle(s) / internal membranes ; cell walls (if present) have different composition ; linear chromosomes ; AVP ;	**2**
(b)	*box 2:* (organism) has two rings of cilia / (organism) stalk absent / AVP ; *box 4:* (organism) has a covering of cilia / (organism) fused cilia absent / AVP ;	**2**
(c)	movement AND nutrition ticked ;	**1**
(d)(i)	bacteria ⟶ *Paramecium* ⟶ *Didinium* ;	**1**
(d)(ii)	*any two from:* ciliates eat (many) bacteria ; *Didinium* / predatory ciliates, eat other (named) ciliates ; ciliates may eat, dead / decomposing, material ;	**2**
(d)(iii)	*any three from:* removal of, harmful bacteria /pathogens, from sewage ; e.g. cholera bacteria *or* any other water born disease / parasites ; stop spread of pathogens via water ; use of chlorination / chemical treatment ;	**3**
(d)(iv)	*any three from:* conversion of ammonia / ammonium (ions), to nitrate (ions) ; convert ammonium ions to nitrite ions ; make nitrate ions available to plants ; nitrate ions are absorbed by plants ; nitrate ions are used to make, amino acids / proteins ;	**3**

16. 0610_s20_MS_42 Q: 3

(a)	*fur colouring* camouflaged so that not seen by prey (when stalking) / reflecting heat / AW ; *streamlined body shape* improved ability to run fast / reduced air resistance / AW / AVP ;	**2**
(b)(i)	transmission of genetic information from generation to generation ;	**1**
(b)(ii)	two of the same letter both lower case ;	**1**
(b)(iii)	0.25 / 25% / $\frac{1}{4}$;	**1**
(b)(iv)	*any two from:* perform a test cross ; by breeding with, homozygous recessive / king cheetah ; if any of the offspring of the test cross are king cheetahs it confirms 17 is heterozygous ; DNA testing ;	**2**
(b)(v)	*any one from:* compare, morphology / anatomy ; compare, DNA / amino acid, sequences ;	**1**
(c)(i)	*any three from:* hunting / poaching ; disease ; lack of, food / prey ; loss of (natural) habitat / urbanization ; pollution / poisoned carcasses ; inbreeding / AW ; climate change ; AVP ;	**3**
(c)(ii)	*any three from:* captive breeding programmes ; local cooperation / education (of farmer / land users) ; national parks / conservation areas / protect habitats ; legislation / public pressure, against hunting ; monitor numbers ; AVP ;	**3**

(a)(i)	*any four from:* deep roots / AW ; to absorb water from the water table / AW ; long and spread out below the surface ; to absorb water when it rains ; root cells have low water potential ; to absorb water by osmosis ; from (very) salty soils / AW ; roots branch many times ; have many roots hairs ; to give a large surface area (for absorption of water) ;	**4**
(a)(ii)	*any three from:* few stomata / low stomatal density ; sunken stomata ; stomata close during the day and open at night ; rolled leaves ; thick epidermis / thick cuticle ; few / no / small, leaves ; hairs on leaves ; low rates of transpiration ; AVP ;;	**3**
(a)(iii)	*any two from:* make / store, toxins ; make / store, foul-tasting substances / AW ; spines / prickles / needles ; resins (that trap insects) ; thick (inedible) leaves ; AVP ;;	**2**
(b)	*any three from:* reduce air pollution ; reduce emissions of, sulfur dioxide ; use filters / 'scrubbers' on chimneys ; catalytic converters ; reduce use of (named) fossil fuel(s) ; example of way to reduce demand for energy ; use low-sulfur (fossil) fuels ; use alternative sources of power ; add lime to soils ; to reduce mobilisation of aluminium in soils / AW ; to raise pH of soils ; AVP ;	**4**

18. 0610_w19_MS_41 Q: 6

	Answer	Mark	Partial Marks
(a)	poor absorption of calcium / weak bones / weak teeth / depression / fatigue / muscle pain / joint pain / rickets / osteomalacia / AVP ;	1	
(b)	*reasons why endangered:* (described) overfishing / hunting ; food chain disrupted (described); overconsumption (by humans) ; (named) pollution ; introduced diseases / species ; habitat destruction ; climate change ; *risks if populations drop:* reduced variation ; reproduction rate is lower / harder to find a mate ; extinction ; AVP ; *how to maintain fish stocks:* education ; quotas ; no-catch zones / nursery zones / seasonal fishing / protected areas / MPAs / Marine Protected Areas ; fines ; restocking ; fish farms ; method of fishing (described) ; AVP ;	6	

19. 0610_w19_MS_42 Q: 1

	Answer	Mark	Partial Marks
(a)(i)	exoskeleton / AW ; jointed / segmented, limbs / legs / appendages / AW ; pairs of, limbs / legs / appendages / AW ; segmented (body) / AW ; bilateral body symmetry ;	2	
(a)(ii)	**Box 2**: *any one from:* animal has, 3 pairs of legs / 6 legs / less 4 pairs of legs / less than 8 legs ; wings ; head, thorax, abdomen / body in three sections ; no, pincers / claws / carapace ; **Box 3**: *any one from:* (animal has) claws / pincers, of different sizes / AW ; eyes on stalks ; smooth, carapace / body / 'shell' ; body, has five sides / is angular ; hairs / bristles / AW, on, legs / claws ;	2	
(b)(i)	4 pairs of legs / 8 legs ; fused head and thorax / cephalothorax / two sections *or* parts of the body ; (pedi)palps / described ; AVP ;	1	
(b)(ii)	inherited feature / controlled by gene(s) / allele(s) / DNA ; functional / AW, feature ; increase, fitness / chances of survival ; increases chance of reproducing (to leave offspring) ; any suitable example visible in *T. grallator* ; e.g. camouflage / warning signal / scares predators / lure for prey / sexual attractant	3	
(c)	*identification can be done using:* base, sequences / order / pattern, in DNA / genes ; each species, has unique / AW, DNA / genes ; *idea that* compare with, reference DNA / base sequences / genes, of known species ; *idea that* if a match with DNA from known species then DNA is from that species OR closely related species have fewer differences in their, base sequences / DNA / genes ; AVP ; e.g. any technique involved in DNA analysis	2	
(d)	hunting / collecting / AW ; pollution ; pesticide(s) / insecticide / (chemical) spray(s) that kill animals / poisons ; loss of habitat / any example ; disease ; increased competition / described ; increase in predator(s) ; climate change / any example ; lack of food / loss of prey species ; AVP ;	3	

20. 0610_w19_MS_43 Q: 4

	Answer	Mark	Partial Marks
(a)(i)	*use of trees* paper ; (as building materials) for furniture / construction / poles / boats / AW ; firewood / fuel ; to sell ; *clearance of trees for* agriculture ; urbanisation / roads / housing / factories / industry / developments ; extraction of, minerals / natural resources ;	3	
(a)(ii)	education ; replanting / reforestation / afforestation ; government policies / legal quota / penalties / controls / bans / rules / AW ; management of conflicting demands ; co-operation with local communities ; protected area / national parks / wardens ; AVP ; e.g. selective felling	3	
(b)(i)	house mouse ;	1	
(b)(ii)	*for hypothesis* all native / nearly all / more / most, species prefer large areas of forest ; **ora** comparative data quote for one mammal, between both areas as a percentage or last column ; heavier / larger, mammals are more (negatively) affected by the breakup of large areas (than smaller mammals) ; **ora** *against hypothesis* not true for, introduced species / black rat / house mouse ; comparative data quote for black rat / mouse, between both areas as a percentage ; cannot make (broad) conclusion on, only study / one area ; AVP ;	4	

21. 0610_m18_MS_42 Q: 3

	Answer	Mark	Partial Marks
(a)(i)	0.2 ;	1	
(a)(ii)	pyramid shape with four trophic levels widest at the bottom ; bars drawn at correct width (□ half a small square) ; each bar labelled with trophic level ;	3	**A** ecf from part **(i)**
(b)	decomposer ;	1	
(c)(i)	photosynthesis ; ref. to chlorophyll ; light energy is transferred to chemical energy ; (named) glucose formed (from carbon dioxide and water) ; named example of carbohydrate molecule used to make biomass ;	3	e.g. cellulose, sucrose, starch, protein, DNA, tissues
(c)(ii)	energy is lost between the trophic levels / energy decreases up the trophic levels ; not all of the organism is, eaten / digested / absorbed ; energy is lost, as heat / in respiration / in metabolic processes / named metabolic process / movement ; energy lost in, excretion / faeces / urine ; (so) less energy to support the next trophic level ;	3	
(d)	**1** prevents extinction / protection of endangered species ; **2** maintains genetic diversity / biodiversity / AW ; **3** maintaining habitat / ecosystem / breeding grounds ; **4** maintain, nutrient recycling ; **5** maintain, resource provision / food / drugs ; **6** maintain, food chains / food webs / trophic levels / description of ; **7** prevent soil erosion / flooding ; **8** AVP ; as a leisure facility / tourism / education	3	

22. 0610_w18_MS_42 Q: 6

	Answer	Mark	Partial Marks
(a)(i)	dry scaly skin ; leathery / soft-shelled, eggs ;	2	
(a)(ii)	cellulose / cell wall ; chloroplast / chlorophyll ; starch grains ; (large / permanent / central) vacuole ;	2	
(b)(i)	amylase ;	1	
(b)(ii)	mouth ; small intestine ;	2	
(c)	monitoring / AW, population(s) / individual(s) ; habitat, protection / restoration ; reducing / prevention, of pollution ; removal / AW, of alien species ; preventing colonisation by alien species ; hunting ban / prevent poaching ; government / legislation, to protect species ; create, exclusion zones / reserves (so not disturbed by people) ; specific, times when / areas where, hunting / AW, not allowed ; international agreements to limit trade ; removal to, zoos / botanical gardens / wildlife parks ; captive breeding / breeding programme (*in situ* or *ex situ*) ; seed banks / frozen zoos / cryopreservation / AW ; artificial insemination / IVF / use of surrogates / AW ; reintroduction programmes ; education / awareness ;	5	
(d)	food ; drugs / medicines ; (named) fuel / biomass for energy ; timber / building materials / AW ; water ; ***ignore*** rain oxygen ; (named) mineral ; gene(s) ; clothing / fur ; AVP ;;;	3	

23. 0610_w18_MS_43 Q: 1

<table>
<tr><th></th><th>Answer</th><th>Mark</th><th>Partial Marks</th></tr>
<tr><td>(a)(i)</td><td>root(s) ;</td><td>1</td><td></td></tr>
<tr><td>(a)(ii)</td><td>small intestine ;</td><td>1</td><td></td></tr>
<tr><td>(a)(iii)</td><td>it is a solvent ;
AVP ;</td><td>1</td><td></td></tr>
<tr><td>(b)</td><td>
<table>
<tr><th>description</th><th>name of process</th><th>letter on Fig. 1.1</th></tr>
<tr><td>dissolved nitrate ions draining into rivers from farmland</td><td>leaching</td><td>F</td></tr>
<tr><td>algae blooms in water caused by leaching of nitrate ions</td><td>eutrophication</td><td>G / O ;</td></tr>
<tr><td>conversion of liquid / water, to, vapour / gas</td><td>evaporation</td><td>O ;</td></tr>
<tr><td>conversion of water vapour into liquid water molecules</td><td>condensation</td><td>P ;</td></tr>
<tr><td>loss of water from plants by evaporation / vapour / $H_2O(g)$ from plant</td><td>transpiration</td><td>H ;</td></tr>
</table>
</td><td>4</td><td>one mark per row</td></tr>
<tr><td>(c)(i)</td><td>prevent (spread of named waterborne) diseases / infections ;
remove / kill, (named) pathogens ;</td><td>1</td><td></td></tr>
<tr><td>(c)(ii)</td><td>1 (polluted) water piped, to sewage treatment works / through J / to K, L,M,N ;
2 screening / removal of, large pieces of waste ;
3 flocculation / coagulation, to separate suspended particles ;
4 settling of, particles / grit / gravel ;
5 digestion by, bacteria / fungi / decomposers / microorganisms ;
6 with aeration (tank) / trickle filter / activated sludge ;
7 sludge treated with anaerobic decomposers / anaerobic digestion ;
8 (water) treated with, chlorine / ozone / UV (light) ;
9 distillation / collection of water from evaporator ;</td><td>4</td><td>A settlement tank / sedimentation
A digestion in reed beds
A charcoal beds / reverse osmosis</td></tr>
</table>

24. 0610_s17_MS_41 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	Aloe ;	1	**R** *Aloe pillansii*
(a)(ii)	**1** (isolated) group of individual plants / AW ; **2** of, one / the same, species ; **3** living in the same area ; **4** at the same time ;	3	
(b)	**1** deforestation ; **2** climate change / global warming ; **3** change in land use / described ; **4** desertification ; **5** pollution ; **6** plant hunters ; **7** increase in (new / invasive), grazers / predators ; **8** competition with, introduced species / alien species ; **9** (new) disease / pests ; **10** lack of pollinators ; **11** AVP ;	3	**A** habitat loss **A** acid rain e.g. quiver trees are (very) slow growing damage to plants by, people / tourists
(c)	**1** high risk of extinction ; **2** less chance of, reproduction / pollination AW ; **3** high risk of genetic diseases ; **4** less / little / no, (genetic) variation ; **5** (small population so) more vulnerable to, pests / disease / catastrophe ; **6** reduced number of alleles ; **7** less likely to, adapt to / evolve to / cope with, (named) change in environment ; **8** AVP ;	3	**A** small gene pool **R** number of genes **MP7** – e.g. new, disease / pest e.g. ref inbreeding ; **R** interbreeding
(d)(i)	44 (%) ;;	2	4 / 9 □ 100 (= 44.4)
(d)(ii)	**1** decrease in population (at all sites) ; **2** **D** has highest mortality / **B** has the lowest mortality ; **3** site **A** has lost the most number of trees / site **D** has lost the lowest number of trees ; **4** use of data from last column to illustrate - minimum of two *or* loss of trees from at least two sites or one site between two years ; comparative data quote **A** 12 to 4 / **B** 9 to 5 / **C** 5 to 3 / **D** 6 to 5 **5** (in whole population) there is no (net) increase in number of trees ; **6** difficult to compare changes over time as numbers are for different sites ; **7** site **A** has most trees in original photograph / site **C** has the least trees in the original photo ; **8** in 2004, **B** and **D** had the most trees / site **C** had the least trees ; **A** more dead tree stumps in site **A** / least dead tree stumps in **D**	3	**A** increase in mortality

25. 0610_s17_MS_43 Q: 4

	Answer	Mark	Partial Marks
(a)	birds / *Aves* ; *Any two features for max 1* ; • feathers • beak / bill • hard-shelled eggs • scaly legs • no teeth • air sacs • light-weight skeletons • AVP	2	**I** wings / four-chambered heart
(b)	1 (isolated) group of individual animals / AW ; 2 of, one / the same, species ; 3 living in the same, habitat / ecosystem / environment / area / place / location ; 4 at the same time ;	3	
(c)	1 killed by predators / not able to evade predators / new predators ; 2 not able to find food ; 3 more prone to disease / AW ; 4 poaching ; 5 ref to, low genetic variation ; 6 competition with new species ; 7 idea of no survival instinct /AW ; 8 AVP ; e.g. techniques not as advanced in 1980	2	**MP 7 A** captive animals unable to 'cope' in wild / too docile / ref to artificial selection / not integrated with wild population of parrots
(d)	1 inbreeding / described ; 2 less / little, (genetic) variation ; 3 reduced number of alleles ; 4 increased risk of genetic disease ; 5 cannot reproduce / sterile ; 6 not enough animals to breed ; 7 less likely to, adapt / to evolve to / cope with, (named) change in environment ; 8 cost ; 9 AVP ;;	3	
(e)	1 to prevent extinction (of many species) / maintain (bio)diversity ; 2 ref to preventing disruption of food, chains / web ; 3 provide, habitats (for shelter / breeding grounds / AW) for many species ; 4 and 5 ecosystems provide, 'service', for humans ; ; 6 idea of areas for, recreation / (eco)tourism / education ; 7 ethical reasons / aesthetic reasons / AW ;	3	**MP 1 A** saves many species **MP 4** examples • ref to flooding / natural disasters • ref to nutrients cycle • ref to maintenance of water cycle • ref to greenhouse gas / carbon storage / carbon sink waste disposal • provide, resources / food / fuel / drugs / raw materials / building materials • provide genes (for selective breeding / genetic engineering)

26. 0610_w17_MS_41 Q: 5

	Answer	Mark	Partial Marks
(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow$; $6H_2O + 6CO_2$;	2	max one mark if not balanced
(b)(i)	sugar beet ; (one of three crops that) falls with appropriate temperature range / **ora** ; sugar beet / corn requirement for rainfall, is in the range ; wheat requires more rainfall ; corn / wheat, has a lower productivity / energy yield ; appropriate use of data ;	3	wheat and corn also grow in suitable temp.(ecf) **A** sugar beet has a higher energy yield than wheat (or corn).
(b)(ii)	stunted / reduced / no, growth / yield ; used to make amino acids / proteins ; amino acids converted to proteins ; named molecule containing nitrogen ;	3	e.g. DNA, enzymes, chlorophyll
(b)(iii)	200 ÷ 0.0001 2 000 000 ÷ 2 □ 10^6 ;	1	
(b)(iv)	less land required ; crops can be used as food (rather than fuel) ; less habitat destruction / less deforestation ; less disruption to food chains / greater diversity maintained ; comparison of algae yield with any crop from Table 5.1, with units ; AVP ;	3	
(c)	development that provides for the needs of an (increasing) human (population) ; without harming the natural environment / ecosystems / habitat ;	2	

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27. 0610_w17_MS_42 Q: 3

	Answer	Mark	Partial Marks
(b)	*population increases* 1 more births than deaths ; 2 more sheep are imported ; 3 more food needed for increasing human population ; *4* *idea that* more sheep needed for, export / economy of Tasmania ; *population remains constant* *5* *idea that* population reaches, carrying capacity / described ; 6 number of births = number of deaths / culling for meat / AW ; 7 any ref to limiting factor(s) in correct context in either increase or plateau ; 8 any example of a limiting factor ; resources food supply water supply space / area of land for grazing / AW disease predators competitors	3	e.g. maximum that the land can support **I** drought / floods / any other natural disaster
(c)	1 *idea that* farmer, chooses / selects (animals that are best adapted to conditions) ; 2 appropriate named feature(s) ; 3 selected animals bred together / (cross) breed them ; 4 select the offspring that show the features required ; 5 repeat, the selection and breeding / the process ; 6 *idea that* imports (male) sheep with desired features to mate with flock ; 7 uses artificial insemination ;	4	
(d)	providing for the needs of (the increasing) humans (population) ; without harm to the (natural) environment / ecosystem(s) / habitat / biodiversity ;	2	**A** examples of development, e.g. roads / houses / cities / urbanisation / AW

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28. 0610_s16_MS_41 Q: 5

	Answer	Mark	Partial Marks
(a) (i)	vertical axis – numbers / population ; horizontal axis – time / years ; curve showing exponential increase / log phase ;	[3]	**I** lag phase / curve starting at origin
(ii)	*idea that* 'birth' / reproduction / breeding, rate is greater than death rate ; no limiting factors ; no/little, competition ; plenty, of food / nutrients / space / mates / oxygen / resources ; no / few, predators ; no / few, parasites / pathogens / disease ; AVP ; e.g. no / little, pollution / waste products / toxins	[max 4]	**I** definitions of exponential growth
(b)	*between 1950 and 2012* mass of fish caught increased and levels off ; 17 to 90 million tonnes / increase = 73 million tonnes ; fluctuations / increases and decreases / described ; e.g. around 1970 / any time after 1990 ; maximum catch, 94 million tonnes / in 1996 ; steep increase between, 1950–1970 / 1973–1989 ;	[max 3]	*units must be used at least once* **A** 16 to 18 / increase of 72 to 74 mp4 cannot be awarded without mp3
(c)	*answers can refer to seas, lakes and / or rivers* international, agreements / treaties ; quotas / permits / licenses ; fines / sanctions, for, overfishing / illegal / unauthorised, fishing ; fishery protection vessels / wardens / patrols / AW ; restrictions on times when fishing can occur ; exclusion zones / nursery zones / 'no take' zones / reserves ; total ban for some species ; regulations on method of fishing ; e.g. mesh size of nets / ban nets / use of lines instead / size of fishing vessel / 'fishing effort' education / raise awareness / any example ; monitoring fish stocks ; captive breeding (of wild fish) ; re-stocking (of wild stocks) ; encourage farmed fish ; e.g. provide subsidies AVP ; e.g. tax on wild fish / increase the cost of wild fish	[max 6]	**A** set maximum mass / number / amount / quantity **A** 'ban unauthorised fishing' **A** consequences other than fines **A** not in breeding season **A** descriptions or examples **A** named examples **I** ban on all wild fish
(d)	*definition of sustainable resource* renewable / self-renewing / regenerates / described ; e.g. produced as rapidly as it is removed resource, does not / will not, run out / become exhausted ; replanting / reseeding / regrowing ; AVP ; e.g. pollarding / coppicing / leaving mature trees	[max 3]	**I** reused / recycled
		[Total: 19]	

29. 0610_s16_MS_43 Q: 5

	Answer	Mark	Partial Marks
(a)	timber / paper, manufacture / AW; firewood; *clearance for* agriculture ; urbanisation / roads / housing / factories / industry / leisure developments ; extraction of minerals / for other natural resources ;	[max 3]	**A** wood unqualified **A** fuel
(b) (i)	118 545 – 90 883 = 27 662 $\frac{27\,662}{118\,545} \times 100$; 23.3(3459) ; 23 (%) ;	[3]	
(ii)	Indonesia has lost the most forest **ora** ; 9% (8.7%) compared with 23% in Indonesia ; Indonesian forest has continued to be lost, whereas loss in Malaysia has slowed between 2005 and 2010 ; comparative use of figures with units ;	[max 3]	**A** 14% more in Indonesia ecf from **(b)(i)**
(iii)	planted forest, has one (dominant) species / is a monoculture ; loss of <u>biodiversity</u> ; qualification of biodiversity loss ; (plantation) susceptible to pest / disease ; nutrients removed / soils become infertile ; *ref to* alien / foreign / invasive / non-indigenous species ; AVP ; e.g. vegetation is removed / lower canopy / all immature	[max 3]	e.g. habitats / example / extinction of a species **I** homes / organisms die **A** use of chemicals
(c)	<u>roots</u> die so do not bind the soil ; loss of soil / soil erosion ; silting of rivers ; reduced (soil) fertility ; no trees to absorb the water ; increased risk of flooding ; increased rate of evaporation / land is exposed to drying ; desertification / decreased soil water ; loss of, habitat / places where organisms live / described ; disruption to food chain / described ; endangered / extinction, of species or loss of biodiversity ; AVP ; named example of affected 'land' organism in context / removed trees cause nutrient cycling disruption / lack of decomposition	[max 6]	**A** landslides **A** loss of, minerals / ions / nutrients **A** mudslides **A** drought / decreased rainfall **I** home **I** organisms die
		[Total: 18]	

30. 0610_w16_MS_41 Q: 2

	Answer	Mark	Partial Marks
(a)	group / number, of organisms / AW, from one species; living in same, area / place / environment / time, together;	2	
(b)	1 mode is / majority / most fish are, between 12.1 and 16.0 cm long; 2 range / body length, varies up to 24 cm / varies 0 to 24 cm; 3 very few fish are less than 4 cm; 4 no fish longer than 24 cm; 5 normal distribution / bell-shaped curve / similar number of fish longer and shorter than the mean; AW 6 Data quote of range with units and thousands of fish; 7 AVP ref to actual range may be shorter than 0–24 cm;	3	**A** mean
(c)(i)	4 + 8 + 10 + 6 + 4 + 2 (thousand); = 34 thousand (fish);	2	
(c)(ii)	quotas / licences / permits / limits; fines for overfishing / taxes; only adult fish caught / young fish returned; (laws to) restrict net size; no fishing, zones / seasons; encourage, fish farms / nurseries / hatcheries / captive breeding; international fishing agreements / treaties; reduce, pollution / silting (of rivers) / avoidance of environmental factors detrimental to fish; education; restocking / add more, fish than removed / AW;	4	**A** 'regulation of fishing' **A** 'eutrophication' if linked to the death of fish.
(d)(i)	genetics / inherited (genes); environmental factors ; any two named environmental factors; (natural) selection;	2	examples of named environmental factors: nutrition / pollution / temperature / predation / disease / fishing
(d)(ii)	bar chart;	1	
		Total: 14	

	Answer	Mark	Partial Marks
(a)	1 ringing allows monitoring of, species / population; 2 to check on (population) numbers; 3 find out about life span; 4 to find out where they go (during migration) / to track their position; 5 find out how far birds travel; 6 to find out when they migrate; 7 allows checks on, health of birds / survival rates; 8 breeding success; 9 do not harm the birds / do not make them obvious to predators; 10 AVP; e.g. information from ringing is used in conservation	2	I 'to track them' unqualified
(b)	1. to prevent extinction; 2. maintain biodiversity; 3. provide feeding grounds for animals / ref. to disruption of food, chains / web; 4. provide, breeding grounds / places for breeding; 5. provide, habitats / shelter; 6. vulnerable to the effects of, development / drainage / AW; 7. ref to flooding / natural disasters; 8. ref to nitrogen cycle; 9. ref to maintenance of water cycle; 10. ref to carbon cycle; e.g. greenhouse gas / carbon storage / carbon sink 11. waste disposal; 12. provide, resources / food / fuel / drugs / raw materials; 13. idea of areas for, recreation / (eco)tourism / education; 14. ethical reasons / aesthetic reasons / AW; 15. AVP; e.g. soil erosion	5	I food chain (singular)
		Total: 7	