OCR
Oxford Cambridge and RSA

GCE

Biology

Unit **F215:** Control, Genomes and Environment

Advanced GCE

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
DO NOT CREDIT	Answers which are not worthy of credit
IGNORE I	Statements which are irrelevant
ALLOW or **ACCEPT**	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
AW	Alternative wording
ORA	Or reverse argument
✓	Mark is awarded
X	Answer incorrect
^	Omission mark
BOD	Benefit of doubt
BP	Blank page
CON	Statement that contradicts a correct statement
●	Use to indicate when part of a mark point has been achieved
ECF	Error carried forward
GM	Mark has already been awarded (given mark)
	Horizontal wavy line to indicate incorrect statements
NBOD	Not giving the benefit of doubt

Here are the subject specific instructions for this question paper

Unless otherwise stated, accept phonetic spelling throughout unless there is clear ambiguity with another term.
For each correct mark point awarded the tick annotation should be used.
Ensure that the answers to all part questions are acknowledged with a suitable annotation – e.g.

- an omission mark or NBOD if the answer is incomplete or not good enough
- a wavy line if some information is inaccurate
- CON if a potential mark point is contradicted
- a cross if the answer is completely wrong.

Use BOD with care and only if you are certain that the answer is close enough to the required information for the mark.

Question			Answer	Marks	Guidance
1	(a)	(i)	carrying capacity ;	1	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **CREDIT** carrying capacity written on the graph, if no answer written or answer crossed out on answer line
		(ii)	(supply / amount, of) food / mice / prey ; predation (upon mink) ; (inter/intraspecific) competition ; (lack of) breeding / nesting, sites ; disease;	2 max	*Mark first **two** answers only, ignoring the numbered sections* **IGNORE** activities of the Mink Project **DO NOT CREDIT** plants **ACCEPT** named predator e.g. eagles **IGNORE** mates / space / shelter / nests, alone **IGNORE** parasites
	(b)	(i)	loss of , (natural/original) biodiversity / species richness ; planting/felling , in one go / not continuous ; disruption to food chains/webs ; prevents a climax community (from being reached) ; destruction of habitats ; soil erosion ;	2 max	**ACCEPT** prevent other species, growing (in conifer monoculture) **ACCEPT** pressure on, rare / endangered, species **ACCEPT** deflected succession , plagioclimax **IGNORE** disrupts / disturbs, habitats

Question			Answer	Marks	Guidance
		(ii)	*social* amenity / recreation / (eco)tourism **;** educational benefit (to visitors / children) **;** improve (mental) well-being **;** *aesthetic* landscape more attractive / AW (for local people / visitors)**;** *ethical* (continuous management) better for local employment **;** duty of care for, habitat / environment / biodiversity / food webs /ecosystems **;**	**4 max**	*Mark as continuous prose* **IGNORE** commercial / economic reasons **ACCEPT** landscape aesthetically pleasing e.g. greater variety of species to look at / deciduous leaf changes / more flowers to see **ACCEPT** prevents soil erosion **IGNORE** vague refs to "playing God" / species have the right to live
	(c)	**(i)**	root suckers / basal sprouts **;** from , meristem / undifferentiated , tissue **;** grow , up around / in circle / between , felled trees **;** correct ref. to time **;**	**2 max**	**IGNORE** refs to genetics **IGNORE** suckers alone **ACCEPT** forms clonal patch / grows close to felled trees e.g. sprouts appear in a few months, **not** "years" / grow quickly
		(ii)	(new sprouts / trees are) <u>clones</u> / <u>genetically identical</u> **OR** no <u>genetic variation</u> **;** (new sprouts) as susceptible, as parent tree (to fungus attack) **;** *idea that* fungus , is systemic / remains in the tree **;**	**2 max**	 **ACCEPT** original / mother tree **ACCEPT** fungal hyphae spread in vascular tissue **IGNORE** fungal spread by, spores / beetles
			Total	**13**	

Question			Answer	Marks	Guidance
2	(a)		DNA **;** polypeptide(s) **;** tertiary, structure / shape **;**	3	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** chromosomes **IGNORE** protein **ACCEPT** 3D, shape / structure **IGNORE** active site
	(b)	**(i)**	animal **and** plant **and** fungi **;**	1	any order **DO NOT CREDIT** other kingdoms
		(ii)	head-tail orientation / anterior-posterior axis **;** position / development, of limbs **;** (traces of) segmentation **;** position / development , of eyes **;**	1 max	**IGNORE** dorso-ventral orientation / head , thorax , abdomen / polarity unqualified **ACCEPT** head at one end, tail at the other **ACCEPT** has limbs **DO NOT CREDIT** head segment / thorax segment / abdomen segment
		(iii)	(**A** to **B**) disappearance of tail / AW **;** (**B** to **C**) webbing / tissues /cells, removed between fingers / toes **;**	2	**(B** to **C) ACCEPT** fingers / toes / digits , become more defined / separate / form individual digits **IGNORE** fingers / toes / digits, forming / developing

Question			Answer	Marks	Guidance
	(c)		1. (at start / parental) grey mice may be heterozygous / AW **;** 2. breed (grey) mice together **;** 3. only breed from individuals that never produce black offspring **;** 4. (continue breeding grey offspring together) for many generations **;** 5. carry out test cross (with black mice) **;**	**4 max**	**ACCEPT** mp1 from annotated genetic diagram 2. **IGNORE** homozygous / heterozygous / IVF 3. **ACCEPT** exclude parents of black offspring from further breeding **;** 4. **ACCEPT** repeat the breeding (process) 5. **ACCEPT** breed black mice with grey mice 5. **IGNORE** back cross
			QWC ;	**1**	**Answer must obtain** mp 2 **followed by** one mark from mps 3 to 5 **Please insert next to the pencil icon:** • **a tick (✓) if QWC has been awarded** • **or a cross (×) if QWC has not been awarded** • **You should use the green dot to identify the QWC terms that you are crediting.**
			Total	**12**	

Question			Answer	Marks	Guidance
3	(a)	(i)	*Biotic - any **one** from* mowing (by workers) **;** impoverished soil community **;** fewer, bees / insects / pollinators **;** lack of grazers **;** *Abiotic - any **one** from* limited space **;** soil chemistry **;** (named) pollution from vehicles (exhaust gases) **;** wind from vehicle (slipstream) **;** mud / dust , covering leaves **;**	2	**Mark the first answer on each line.** If that answer is correct and an additional answer is given that is implausible or contradicts the correct answer then = **0 marks** **IGNORE** any suggestion that would apply equally to both surroundings. **ACCEPT** nitrifiers / worms **ACCEPT** road-salt, toxins from oil or rubber , soil pH **ACCEPT** particulates / lead / NO_x / SO_x / CO **DO NOT CREDIT** carbon dioxide
		(ii)	*(the shoot is)* growing, towards light / upwards **;**	1	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** bending unqualified / away from wall / towards sun e.g. 'shoot bends and grows towards the light' = 1

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>Problem to be solved</th><th>Hormone</th></tr>
<tr><td>Bananas picked green and shipped in a container are not ripe when the ship arrives.</td><td>E / Ethene ;</td></tr>
<tr><td>Pot plants grown for sale at Christmas will not be bought if their leaves drop off.</td><td>A / Auxin ;</td></tr>
<tr><td>Barley grains delivered to a brewery do not contain much maltose for the yeast.</td><td>G / Gibberellins ;</td></tr>
<tr><td>In plant tissue culture, calluses on plain agar will be too slow in developing shoot buds.</td><td>C / Cytokinins ;</td></tr>
</table>
</td><td>4</td><td>Mark the first answer in each box. If that answer is correct and other material is added that is incorrect or contradicts the correct answer then = 0 mark</td></tr>
<tr><td></td><td>(c)</td><td></td><td>fungi / bacteria / microorganisms ;

on / from, the <u>explant</u> ;
contaminates / in, agar / medium ;

idea of competition for resources (between microorganisms and explant) / decrease in nutrients (in culture medium) ;</td><td>2 max</td><td>ACCEPT pathogens
IGNORE parasites

ACCEPT culture
IGNORE infection

IGNORE competition for space</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>idea that Rhizobium is, involved in nitrogen fixation / not involved in nitrification ;

(Rhizobium) will not reduce / increases levels of, ammonia / ammonium ions ;</td><td>1 max</td><td>IGNORE refs to plant host / symbiosis / legume / nodules / not aquatic / not free living

ACCEPT description e.g. Rhizobium produces, ammonia / ammonium ions from nitrogen gas

ACCEPT NH_3 / NH_4^+</td></tr>
</table>

Question			Answer	Marks	Guidance
		(ii)	use of (micro)organisms to, remove / oxidise, ammonia / ammonium ions **;** use of (micro)organisms for , commercial process / industrial process **;**	**1 max**	**ACCEPT** NH_3 / NH_4^+ **IGNORE** 'prevents build- up of ammonia' **IGNORE** refs to products of nitrification / food production / drug production / for human benefit
		(iii)	*idea that* the desired product is *Nitrosomonas (europaea)* (cells) **;** enzymes / proteins , are <u>denatured</u> (by incorrect pH) **;** enzymes needed for , (named metabolic) processes in growth **;** (incorrect pH) disruption of, tertiary / 3D,structure / shape **;** *ref to* effect of hydrogen ions on , H / ionic , bonds **;**	**3 max**	**ACCEPT** increases yield of *N. europaea* **IGNORE** ref to products of *Nitrosomonas europaea* **DO NOT CREDIT** nitrogenase is denatured **CREDIT** enzymes for, respiration / protein synthesis / cell reproduction / DNA replication **IGNORE** active site
	(e)	(i)	unit should be in (column) headings **;**	**1**	
		(ii)	number of bacteria (in bacterial suspensions) **;** plantlets not sterilized **;** (initial) size / mass , of plantlets **;** concentration of ammonia solution **;**	**1 max**	**ACCEPT** "concentration" of bacteria **IGNORE** amount of bacteria **IGNORE** decimal places of grams / duration of trial / age of plantlets / time of day dry mass measured / volume of sand / number of plantlets
			Total	**16**	

Question			Answer	Marks	Guidance
4	(a)	(i)	25 (%);	1	**IGNORE** working
		(ii)	1. (island edges / cacti) subject to, sea/salt, spray ; 2. qq (genotype) confers ability to obtain water from salt spray; 3. (gives) selective advantage ; 4. (individuals with qq genotype) survive / reproduce ; 5. allele / q, frequency increases ; 6. directional selection ; 7. geographic , isolation / barrier ; 8. (means) no new alleles coming in ;	4 max	**ACCEPT ORA** for mp 2 – 5 **IGNORE** mist / sea water for **mp1 and 2** **ACCEPT** homozygous recessive / 'they' for qq genotype **2.ACCEPT** qq gets water supply from salt spray **2.ACCEPT** qq genotype confers tolerance to salt (spray) **3.ACCEPT** description e.g. 'they are (at an advantage and are) selected for' **5.DO NOT CREDIT** gene frequency increases **5. IGNORE** 'qq frequency increases' **6.IGNORE** natural selection

Question			Answer	Marks	Guidance
	(b)		T1. lay, tape / string , in a line / across zones **;** T2. from sea to post-pioneer (boundary) / AW **;** T3. perform , line / belt, <u>transect</u> **;** Q4. (frame / open / point) <u>quadrat</u> **;** Q5. placed systematically / back to back / intervals (along tape) **;** K6. use a <u>key</u> **;** K7. identify <u>species</u> present **;** K8. estimate percentage cover / count plants / <u>species</u> frequency / use ACFOR scale **;** R9. ref. to repeated sampling over time **;** R10. ref. to repeated sampling in one area **;**	**6 max**	Look for wording that indicates up to the end of the pioneers or to first post-pioneers, e.g. top of dune ' lay tape across salt spray and rain - watered zone' = T1 and T2 **Q5. DO NOT CREDIT** randomly **K8. IGNORE** percentage abundance
			QWC – award if **TWO** items of equipment above is linked to description of correct use **;**	**1**	Award if any **TWO of the following pairs** of marking points have been awarded : **T1,T2/ T3** **Q4,Q5** **K6,K7/ K8** **Please insert next to the pencil icon:** • **You should use the green dot to identify each pair of mps that you are crediting** • **a tick (✓) if QWC has been awarded** • **or a cross (×) if QWC has not been awarded**

Question	Answer	Marks	Guidance
(c)		3 max	*Marks awarded for **activity** (within the categories given) correctly **linked** to **effect***
	Activity: agriculture / farming / roads / building / deforestation ,		
	Effect: soil erosion / habitat destruction / loss of biodiversity**;**		**IGNORE** disruption / disturbance, of, habitat / biodiversity
	Activity: introduced (animal) species,		**ACCEPT** named animal species e.g. cats
	Effect: (native) animal / bird / egg, predation **OR** (native) plant damage / grazing **OR** (interspecific) competition **;**		**ACCEPT** destroys nests
	Activity: tourism / recreation,		
	Effect: litter / sewage / habitat destruction / loss of biodiversity **;**		**IGNORE** pollution unqualified **IGNORE** disruption / disturbance, of, habitat / biodiversity
	Activity: shipping ,		
	Effect: oil spills / sewage / bilge / (named) flotsam **;**		**ACCEPT** named example (e.g.plastic) **IGNORE** pollution unqualified
	Activity: (over-)fishing / hunting,		
	Effect: disruption of food chains **OR** (native) species , are threatened / may become extinct**;**		**IGNORE** loss of biodiversity **ACCEPT** 'kills species' **ACCEPT** named species e.g. sea cucumber / sharks / tortoises
	Total	**15**	

Question			Answer	Marks	Guidance
5	(a)		1 (named) receptor detects, stimulus / change in environment ; 2 sensory neurones conduct action potentials ; 3 (from receptors) to CNS **;** 4 motor neurones conduct action potentials ; 5 (from CNS) to <u>effector</u> **;** 6 relay / intermediate, neurones conduct action potentials **;** 7 from sensory to motor neurones; 8 *ref to* role of synapses ; 9 (CNS / brain) coordinates response **;**	**4 max**	***For mp2,4,6 action potentials / impulses must be mentioned at least once*** **2.ACCEPT** impulses **2.IGNORE** messages / signals. **3.ACCEPT** brain/spinal cord **4.ACCEPT** impulses **4.IGNORE** messages / signals. **6.ACCEPT** impulses **6.IGNORE** messages / signals. **8.ACCEPT** summation / creation of new pathways / interconnection of existing pathways / memory / learning / filtering (out) low-level <u>stimuli</u> / inhibitory / excitatory **9.ACCEPT** coordination described
	(b)		glycogen converted into glucose (in liver)**;** glucose released into blood **;** (carried / available) to cells **;** (glucose needed for) respiration / glycolysis **;** to release energy / make ATP **;** for increased, breathing rate / heart rate / muscle contraction **;**	**3 max**	**ACCEPT** increased levels of blood glucose **DO NOT CREDIT** ref to producing / creating **,** energy **ACCEPT** more energy available **ACCEPT** increased muscle activity **IGNORE** 'adrenaline increases breathing rate /heart rate' alone , 'rabbit runs quicker'

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Organ</th><th>Type of muscle</th><th>Action of <u>muscle</u> in fight or flight response</th></tr>
<tr><td>Heart</td><td><u>cardiac</u></td><td>increase pulse rate</td></tr>
<tr><td>Leg muscle</td><td>voluntary / skeletal/striated</td><td>contract</td></tr>
<tr><td>Arteriole to liver</td><td>smooth</td><td>contract / relax</td></tr>
</table>
;
;
;
</td><td>3</td><td>Mark the first answer in each box. If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks.

IGNORE relax for second box

ACCEPT (vaso)constrict / (vaso)dilate for third box (as in context of effect of muscle on arteriole)
IGNORE increases/decreases, blood flow
IGNORE increases/decreases,diameter</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><u>myosin</u> ;</td><td>1</td><td>IGNORE thick filament.
DO NOT CREDIT myelin
Mark the first answer. If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks.</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>avoidance of predation / desiccation / overheating ;</td><td>1 max</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>shine a light/torch on slugs, when feeding / at night / in dark ;
Idea of repeated (stimulus) ;
(observe) reaction / response , diminishes / stops ;</td><td>2 max</td><td>

ACCEPT no longer moves away from light
IGNORE ' slugs learn to ignore the light'</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>

taxis / kinesis ;</td><td>1</td><td>Mark the first answer. If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks.

ACCEPT (negative)phototaxis
DO NOT CREDIT positive phototaxis</td></tr>
</table>

Question			Answer	Marks	Guidance
	(e)	(i)	social behaviour **;**	1	**If more than one box is ticked then = 0 marks.**
		(ii)	bones of lower arm / radius and ulna, are longer **;** muscles are longer / more muscle tissue **;** (so) more muscle fibres (to deliver contracting force) **;**	2 max	*each marking point must be comparative* **IGNORE** longer arms / longer levers / longer bones **ACCEPT** 'they' for muscles **ACCEPT** muscles have greater, volume / mass **IGNORE** more muscles / bigger muscles / muscle density **ACCEPT** more, muscle cell / myofibrils / sarcomeres / motor units
			Total	18	

Question			Answer	Marks	Guidance
6	(a)	(i)	χ^2 = 10.48 / 10.480 / 10.5 ; ; ; ;	4	

Indicator species	E	O	O - E	$(O - E)^2$	$\frac{(O - E)^2}{E}$
Stonefly nymph	58	44	-14	196	3.38
Freshwater shrimp	33	43	10	100	3.03
Water louse	7	12	5	25	3.57
Sludge worm	2	1	-1	1	0.50
			;	;	;

Correct answer = 4 marks

If answer is incorrect or missing then
CREDIT correct working in table columns as follows:

All figures in one column correct = 1 mark to **3 max**

DO NOT CREDIT column mark if minus signs on figs missing or incorrect
IGNORE number of d.p.in table
CREDIT fractions for last column
ALLOW ecf from any incorrect column to the next and for χ^2.

Question			Answer	Marks	Guidance
		(ii)	calculated value / χ^2 / 10.48 / 10.5, is (much) larger than, critical value / 7.81 **; ORA** *idea that* probability that these results are due to chance is (much) less than, 5% / 0.05**; ORA** conclusion is justified / result not due to chance / significant difference between observed and expected results (at the 0.05 level)**;**	**2**	**ALLOW** ecf for a correct explanation that corresponds to the candidate's incorrect calculation for (a)(i) **ACCEPT** probability lies between, 5%/0.05, and 1%/0.01 confidence limits **IGNORE** ref to null hypothesis
	(b)	**(i)**	all the living organisms and non-living components (in a habitat), and their interactions **;**	**1**	**ACCEPT** all the biotic and abiotic components (in a habitat), and their interactions **ACCEPT** all community and abiotic environment and their interactions **ACCEPT (**inter)relationships for interactions
		(ii)	*biotic because:* manure contains, bacteria / microorganisms**;** manure contains, straw / plant material (for bacteria) **;**	**1 max**	*Green blob biotic, then look for reason.* If biotic not given = 0 mark **ACCEPT** 'it' for manure **IGNORE** food **IGNORE** refs to oxygen concentration / BOD.
	(c)	**(i)**	feeding / eating / consuming / ingesting **;**	**1**	**IGNORE** digestion/ heterotrophic nutrition/ predation
		(ii)	shrimp to fish **;** (because) more indigestible parts (in shrimp) **;** **OR** fish to kingfisher **;** (because) more indigestible parts (in fish) **;** **OR** kingfisher to hawk **;** (because) kingfisher, is small / has large SA : Vol ratio / has more indigestible parts**;**	**2**	*Marks awarded for **link in food chain** correctly **linked** to **explanation*** **ACCEPT** named parts e.g. outer skeleton /shell **ACCEPT** named parts e.g. scales/ bones **ACCEPT** more energy lost as heat **ACCEPT** named parts e.g. bones /feathers/beak
			Total	**11**	

Question			Answer	Marks	Guidance
7	(a)	(i)	step 3, should be between 1 and 2 / should be second **;** **OR** step 2, should be between 3 and 4 / should be third **;**	1	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks.**
		(ii)	step 2, enzyme should be <u>restriction</u>**;**	1	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks.**
	(b)		chemical synthesis / polynucleotide sequencing**;**	1	**ACCEPT** make an artificial (gene) / manufactured (gene) / synthetic (gene) **IGNORE** refs to gene bank, cDNA library, BAC's , using reverse transcriptase/ making cDNA from RNA
	(c)	(i)	(bacteria) acquire / take up / gain , (useful) genes **;** example of useful gene**;** fast<u>er</u> / without waiting for mutation **;**	2 max	**ACCEPT** sharing genetic information/ increase genetic variation / sharing DNA **IGNORE** ' transfer / passing on genes' **ACCEPT** (gene for) antibiotic resistance, enzyme to metabolize new nutrients **DO NOT CREDIT** 'become immune to antibiotics' Look for the idea of accelerated acquisition .e.g. quick<u>er</u> /in one generation
		(ii)	(DNA) <u>ligase</u> **;**	1	**Mark the first answer.** If that answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks.**

Question			Answer	Marks	Guidance
	(d)	(i)	*phytoene synthase* is, limiting / in low quantities / low activity**;** little, phytoene / substrate, for *phytoene desaturase* **;** little, lycopene/ substrate, for *lycopene β cyclase***;**	**2 max**	
		(ii)	different base sequences (in the different genes/ DNA**) ;** different amino acid sequences (in the different enzymes) **;** different, tertiary/3D, structures/ shape (in the different enzymes) **;**	**2 max**	**ACCEPT** different, triplet /codon/ nucleotide, sequences. **ACCEPT** different primary structures **ACCEPT** refs to active site different shape
	(e)		*For:* relief of, vitamin A deficiency / symptoms of vitamin A deficiency **;** *Against:* expense of, seed to (poor) growers / grain to consumers **;** (uncontrolled) hybridization with other <u>rice</u>, species / types / varieties**;** unknown long-term effects on consumers' health **;**	**2 max**	**IGNORE** refs to other instances of genetic engineering. **ACCEPT** prevents blindness, improves immune system, increase vitamin A uptake **IGNORE** helps eyesight / prevents death **ACCEPT** refs to putting (non GM) farmers out of business **IGNORE** refs to gene crossing to different plant species. **IGNORE** refs to "against nature", "playing God", loss of biodiversity

Question	Answer	Marks	Guidance
(f)	differences in organ size **;** difference in body temperature **;** earlier aging of organs **;**	**1 max**	e.g. organs too small / organ size not compatible **IGNORE** rejection idea (as applies to both animals)
(g)	**S1** cannot be inherited **OR** **G1** can be inherited **;** **S2** introduces (functional), gene/allele, into, patient/ body cell /non reproductive cell **OR** **G2** introduces, (functional), gene/allele, into sperm / egg / zygote/ embryo **;** **S3** only some cells have (functional), gene/ allele **OR** **G4** all cells have (functional), gene/ allele**;** **S5** short lived / temporary / needs repeating **OR** **G5** long lived / permanent / does not need repeating**;**	**2 max**	***one mark for somatic (S) and one mark for germ line (G)*** **IGNORE** ref to legality / ethical issues **S1 /G1 ACCEPT** (gene /allele) passes e.g. S (gene / allele) does not pass to offspring **S1** / **G1 IGNORE** (gene / allele**)** affects e.g. G (gene / allele) does not affect offspring **S2** / **G2 DO NOT CREDIT** altering / removing / replacing, genes
	Total	**15**	

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