B1 INTERVENTION MARK SCHEME

Question			Answer	Marks	Guidance
1	(a)		dominant — two alleles of a gene that are different genotype — the genetic makeup of an organism heterozygous — an allele that always shows an effect in the organism homozygous — an allele that only shows an effect if both alleles of the pair are the same phenotype — the observable characteristics of an organism recessive — two alleles of a gene that are the same	3	all correct = 3 marks 4 or 5 correct = 2 marks 3 correct = 1 mark
	(b)	(i)	gg Gg; gg gg Gg gg; Gg gg;	3	1 mark for each correct row if no fully correct rows allow 1 mark for all homozygous recessives (gg) correct **accept** alternative letters if clearly upper and lower case used correctly
		(ii)	gg X gg Gg X Gg Gg X gg OR gg X Gg	2	combinations can be in any order **accept** Gg either way round (Gg or gG) all correct = 2 marks 2 correct = 1 mark

Question			Answer	Marks	Guidance
	(c)		risk of test egrisk of miscarriage/risk of infection/harm to fetus/risk to mother; will they terminate/abort; false negatives and positive results/test is not 100% accurate;	3	must have the idea of harm to mother or fetus do not allow "affect" fetus **accept** idea of not keeping the fetus do not credit references to ethical or financial considerations
			Total	**11**	

Question	Answer	Marks	Guidance
2	**Level 3 (5–6 marks)** **Explains** how clones can be formed in plants **and** animals. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Explains** how clones can be formed in plants **or** animals. Quality of written communication partially impedes communication of the science at this level. **Level 1 (1–2 marks)** Shows understanding of what is meant by clones and gives examples in plants and/or animals Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A** **Indicative scientific points at Level 2 and 3 may include:** **Animals** • twins fertilised zygote separates, both halves develop into an individual (natural) • Greenfly reproducing asexually (natural) • nucleus of body cell transferred to empty egg cell (artificial) **Plants** • description of the formation of a runner/bulb (natural) • description of tissue culture or taking a cutting (artificial) **Indicative scientific points at Level 1 may include:** • clones are genetically identical • produced by asexual reproduction • human identical twins • runners or bulbs • (tissue culture) taking a cutting • nuclear transfer Ignore references to bacteria/mayfly **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

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<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
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<tr><td>3</td><td>a</td><td></td><td><table>
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Idea that Greg does not care/does not understand about the risk of heart disease (1)
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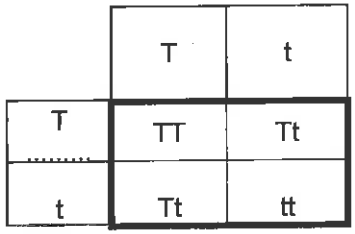
Question			Answer	Mark	Guidance
3	(a)		<table><tr><td>alleles</td><td>✓</td></tr><tr><td>genes</td><td></td></tr><tr><td>shape</td><td></td></tr><tr><td>size</td><td></td></tr></table> (1)	1	
	(b)	(i)	<table><tr><td colspan="2"></td><td colspan="2">Mother</td></tr><tr><td colspan="2"></td><td>X</td><td>X</td></tr><tr><td rowspan="2">Father</td><td>X</td><td>XX</td><td>XX</td></tr><tr><td>Y</td><td>XY</td><td>XY</td></tr></table> (1)	1	one mark for correctly completed Punnett square accept also <table><tr><td colspan="2"></td><td colspan="2">Mother</td></tr><tr><td colspan="2"></td><td>X</td><td>X</td></tr><tr><td rowspan="2">Father</td><td>Y</td><td>XY</td><td>XY</td></tr><tr><td>X</td><td>XX</td><td>XX</td></tr></table> And allow x for X, y for Y
		(ii)	50:50	1	Accept also 1:1 or 2:2. No e.c.f. from (b)(i)
	(c)	(i)	1 : 1 (1)	1	**allow** 50:50 **do not allow** 350:350 or any other ratio
		(ii)	evidence of some calculations to show the ratios (1); ratio girls:boys gets further away from expected as total number of babies decreases (1); smaller sample means that the estimate is less accurate and hence further from expected (1)	3	needs evidence of comparison of ratios in at least two hospitals – can refer to fractions Or reverse argument. This mark is for describing the differences in ratios. Idea of larger sample size gives better results. This mark is for explaining why the ratio approaches the expected value as the number increases.
			Total	**7**	

Question			Answer	Marks	Guidance
1	(a)		genotype → the combination of alleles in an organism heterozygous → when two alleles for a gene, in an individual, are different homozygous → when two alleles for a gene, in an individual, are the same phenotype → the observable characteristics of an organism the alternative form of a gene	3	all correct = 3 marks one mistake = 2 marks two mistakes = 1 mark do not allow any box which has more than one line to or from it count the errors here – loses a mark for every error
	(b)		(structural) collagen/keratin/actin/myosin **AND** (functional) enzyme/protease/amylase/lipase/haemoglobin (1)	1	**BOTH** needed for the mark. allow tissue predominantly protein, e.g. 'muscles', 'hair' or 'fingernails', in first space
			Total	4	
2	(a)		correctly completed Punnett square (1); probability: 0.5/50%/½ (1)	2	**accept** use of other letters (**not** x, y) mother: h, h / father: H: Hh or hH, Hh or hH; h: hh, hh OR mother: h, h / father: h: hh, hh; H: Hh or hH, Hh or hH **allow** ecf but accept 0.5/50%/½ even if Punnett square does not predict it

Question			Answer	Marks	Guidance
2	(b)	(i)	**Level 3 (5–6 marks)** Answer considers implications to Heather and her family using examples across different areas to develop the consequences. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Answer considers implications to Heather and to her family using an example to develop the consequences. Quality of written communication partly impedes communication of science at this level. **Level 1 (1–2 marks)** Answer considers an implication to Heather or her family. Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C** family = principally Heather's partner and children in this context, but allow siblings and mother ignore use of the term 'carrier' to mean 'having the affected allele' **Indicative scientific points may include:** • will know if she has the disease • will enable her to prepare • will enable her to plan treatment • will allow her to plan a family • results may not be accurate (false positives/negatives) • may not want her family to know • may not want to know herself • could cause stress or anxiety • employer could obtain information • might mean less chance of promotion • might mean more chance of losing job • could increase insurance premiums **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	(b)	(ii)	people reproduce before they know that they have Huntingdon's disease (1); condition/gene/it gets passed on/does not disappear (1); higher mutation rate (1)	2	2nd marking point can be implied or reverse argument e.g. 'people with other genetic diseases may decide not to have children because they know what they may get'
			Total	**10**	

Question			Answer	Mark	Guidance
1	a		 Probability = 0.25	3	one mark for **correct** parent genotypes (both Tt/ tT) incorrect genotypes do not credit for ecf marks one mark for correct completion of Punnett Square. Allow correct alternative genetic diagram. one mark for correct probability Use of alternative symbols (as long as upper and lower case of same letter is clear). Max 2 marks. allow 1/4 or 25% or 1 in 4 or 1:3 ignore 1 in 3
	b	i	idea of lots of (fetal) cells / don't need to separate mother's cells from fetal cells	1	ignore more accurate/reliable
	b	ii	less painful / invasive / less risk of miscarriage / less equipment needed	1	accept idea it is safer/easier accept idea that it can be done earlier in the pregnancy

Question	Answer	Mark	Guidance
c	**[Level 3]** Answer gives reasons from more than two areas why a couple may or may not choose to have the test done. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Answer gives reasons from more than one area why a couple may or may not choose to have the test done. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Answer states a reason why a couple may or may not choose to have the test done. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Ethical/moral/religious:** may or may not believe in testing may or may not believe in terminations may or may not be worried about discrimination against a disabled child may or may not believe there should be any interference in nature (idea of playing God) **economic:** may or may not be able to afford care for child / treatment / counselling (since medical services cost in some countries) **medical:** increased risk of miscarriage risk to health of mother as a result of termination risk to health of mother / fetus as a result of testing false negative/positive test. Accuracy of the test. plan for future medical treatment **circumstances:** may or may not have other healthy children to consider may or may not have been trying for a baby for a long time may or may not have had many miscarriages prior to this baby may or may not plan for the future **general:** can make decisions regarding termination may, or may not, want to know whether the child has the disease couples will make different judgements about risks and benefits of the test idea that perception of risk is different to actual risk the quality of life the child/parents will have
	Total	**11**	

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<tr><td>1</td><td>(a)</td><td>(i)</td><td>Sarah AND Wendy (1)</td><td>1</td><td>accept either way round</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Mary AND Dave (1)
Pete AND Liz (1)
Jane (1)</td><td>3</td><td>minus 1 mark for each name over five names
names can be in any order.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table>
<tr><td>Cystic fibrosis is caused by a recessive allele.</td><td>✓</td></tr>
<tr><td>The symptoms of cystic fibrosis appear at about the age of forty.</td><td></td></tr>
<tr><td>Cystic fibrosis is caused by environmental factors.</td><td></td></tr>
<tr><td>The symptoms include difficulty in breathing because of thick mucus.</td><td>✓</td></tr>
<tr><td>If a person with cystic fibrosis has a non-carrier partner, there is a 50:50 chance of having children with cystic fibrosis.</td><td></td></tr>
<tr><td>The genotype of a cystic fibrosis carrier is heterozygous.</td><td>✓</td></tr>
<tr><td>The alleles for cystic fibrosis occur in two different places on the same chromosome.</td><td></td></tr>
<tr><td>Cystic fibrosis can be transmitted by coughs and sneezes.</td><td></td></tr>
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<tr><td>1</td><td>a</td><td>i</td><td>Harold: ff Hilda: Ff</td><td>1</td><td>need both for the mark
allow fF for Hilda
do not credit if the distinction between the capital letter and the small letter is not clear.</td></tr>
<tr><td></td><td>a</td><td>ii</td><td><table><tr><th>Harold</th><th>Hilda</th><th></th></tr><tr><td>heterozygous</td><td>homozygous dominant</td><td></td></tr><tr><td>heterozygous</td><td>homozygous recessive</td><td></td></tr><tr><td>homozygous dominant</td><td>heterozygous</td><td></td></tr><tr><td>homozygous dominant</td><td>homozygous recessive</td><td></td></tr><tr><td>homozygous recessive</td><td>homozygous dominant</td><td></td></tr><tr><td>homozygous recessive</td><td>heterozygous</td><td>✓</td></tr></table></td><td>1</td><td>no ecf from ai

If more than 1 box is ticked, no mark awarded..</td></tr>
<tr><td></td><td>b</td><td></td><td>Any two from
idea of F/dominant allele being inherited from Hilda / Harold will only pass on one f allele (1)
so child might be heterozygous/carrier/ Ff (1)
there is a 50% chance (1)
need 2 recessive alleles to have cystic fibrosis/homozygous recessive/ ff (1)</td><td>2</td><td>Ignore Hilda is a carrier

Points could be awarded from a correctly annotated diagram.

Do not credit gene instead of allele</td></tr>
<tr><td></td><td>c</td><td></td><td>Any three from
risk of miscarriage/ harm (the foetus/mother)/risk of infection (1)
termination/abortion (1)
false positive / negatives/not accurate/reliable (1)
who should be told (1)
religious/ethical concerns (1)
insurance/job implications (1)</td><td>3</td><td>Ignore damage unless qualified
ignore reference to safety
ignore ‘don’t want to know’</td></tr>
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Question			Answer	Mark	Guidance
grey shading in first column indicates overlap with A141/01; shading in 3rd column indicates IG1					
1	(a)		egg cells fertilised embryos	2	All 3 correct = 2 marks 2 correct (only one error) = 1 mark 1 correct = 0 marks
	(b)		*any two from:* should / should not be allowed to choose the characteristics of our children (1); difficult to decide when it is and isn't acceptable (1); lots of embryos are not used / will be destroyed (1); interfering with the course of nature/playing God (1)	2	e.g. choice of gender
	(c)		*for:* find out if the baby has the disease (1); find out if the baby is a carrier (1); enables parents to plan (1); may decide to terminate the pregnancy (1) *against:* risk of miscarriage/damage to fetus/damage to mother (1); results may not be reliable / idea of false positives or false negatives (1); it's better not to know (1); interfering with the course of nature/playing God (1)	3	max 2 for each argument may have two points in a single sentence, e.g. 'be prepared if the baby has the disease' = 2 marks 'so they can terminate if it has the disease' = 2 marks e.g. "it's better to know" this could imply " you should have the baby whether or not it has c.f." or " it would be too stressful to find out that the baby has it"
			Total	**7**	

Question			Answer	Marks	Guidance
2	(a)		D F E (A) C G B (2)	2	DFE gets (1); ('Don't Forget Eggs') CGB gets (1) ('Can't Get Better')
	(b)		**Level 3 (5–6 marks)** Identify at least two distinct implications and at least two concerns, which are clearly linked. Answer must relate to the case of saviour siblings which may be implied. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Identify at least two implications and at least two concerns, which are not necessarily linked. Answer must relate to the case of saviour siblings, which may be implied. Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Identifies at least two implications or concerns (or one of each, not necessarily linked). May not refer to saviour siblings. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A/A*** **Indicative scientific points about implications may include:** • saves the life of the daughter • no blood transfusions • fewer stays in hospital / infections • less stress for the family. • Government needs to decide what is and isn't allowed with regards to embryo selection. • false positives or negatives • medical intervention on saviour sibling • unused embryos are discarded **Indicative scientific points about concerns may include:** • child only born to be a saviour sibling • would not have been chosen otherwise • is it right to select embryos for their characteristics (even if they have the potential to save other lives) • discarding of other embryos is unethical • some people don't like the idea of 'playing God' • could cause the brother stress in the future / low self-esteem • brother too young to be involved in the decision to use his stem cells. • expensive • general idea of medical procedures carrying risk or distress to mother or saviour sibling **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**8**	

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			Total	6	