

Question Number	Answer	Additional Guidance	Mark
1 (a)	1. genotype AND gametes of parents shown ; 2. genotypes of possible children correctly shown ; 3. genotypes clearly matched to phenotypes of possible children ; 4. (probability =) $\frac{1}{4}$ / 25% / 1 in 4 / 0.25 ;	1. gametes can be shown on Punnett Square 3. ACCEPT carrier as phenotype 4. ACCEPT incorrect probability but based on their cross	(4)

Question Number	Answer	Additional Guidance	Mark
1 (b)	1. method for obtaining sample from baby described e.g. cheek swab, blood sample, heel prick, biopsy} ; 2. idea of extracting DNA (from cells) ; 3. test for presence of {normal / recessive / mutant / defective / MLD / eq} {gene / allele} ;	NOT Mp 1 and 2 if chorionic villus, amniocentesis, pre-implantation, etc 2. IGNORE testing DNA 3. CCEPT even if method incorrect for Mp 1	(2)

Question Number	Answer	Additional Guidance	Mark
1 (c) (i)	1. idea of copy of {normal / functioning / eq} {gene / allele} now in cells ; 2. reference to transcription or translation of the {gene / allele} ; 3. idea that (normal) protein produced / cells function normally / eq ; 4. idea that stem cells produce more cells ;	1. NOT replaces / repairs faulty gene IGNORE dominant ACCEPT correct 4. ACCEPT mitosis, cell division	(3)

Question Number	Answer	Additional Guidance	Mark
1 (c) (ii)	1. idea of control (to see if the treatment made a difference) ; 2. idea that other variables controlled e.g. shared genes , environment ;	1. ACCEPT valid comparison IGNORE unqualified comparison 2. ACCEPT similar genes NOT genetically identical	(2)

Question Number	Answer	Additional Guidance	Mark
1 (d)	1. idea that risk from gene therapy very small ; 2. idea that consequences of the disorder more certain than risks of the therapy ; 3. idea that consequences of the disorder known while risks of the therapy are not known ; 4. idea that parents do not want their child to suffer the disorder e.g. will do anything to {treat / prevent / eq} the disorder, there is no other treatment available ; 5. idea that trial may lead to effective treatment e.g. could benefit others ;	2. ACCEPT more benefits than risks / idea that severity of the disorder makes it worth the risk 4. ACCEPT give the child a better quality of life / the best possible chance of a normal life / eq	(2)

Question Number	Answer	Additional guidance	Mark
2(a)	<ol style="list-style-type: none"> 1. idea of more than one gene for a single characteristic ; 2. at different loci / eq ; 3. idea of giving rise to continuous variation ; 	<ol style="list-style-type: none"> 1. IGNORE alleles ACCEPT 'a phenotype' if specific 	(2)

Question Number	Answer	Additional guidance	Mark
2(b)	<ol style="list-style-type: none"> 1. malnutrition / lack of { nutrients / a named nutrient e.g. protein, calcium / eq } ; 2. idea of nutrient required for specified growth e.g. muscle, bone ; 3. idea of other relevant environmental factor that affects expression of genotype for height e.g. health ; 4. idea of an environmental factor determining achievement of (genetic) potential ; 	<ol style="list-style-type: none"> 1. ACCEPT deficiency 3. CEPT disease 	(3)

Question Number	Answer	Additional guidance	Mark												
2(c)(i)	<ol style="list-style-type: none"> increased for { all / both Northern and Southern } Europeans / eq ; greater increase for Southern Europeans than Northern Europeans / faster rate of increase for Southern Europeans ; idea of greatest increase for Southern Europeans from 1970 to 1975 ; idea of fall in height for Northern Europeans between 1970 and 1975 ; manipulation of data to either show the increase of both or to show that the increase was greater for Southern Europeans than Northern Europeans ; 	<ol style="list-style-type: none"> ACCEPT separate contents for North and South ACCEPT converse <p>Mp2 can also gain Mp1 if height referred to</p> <p>5. ACCEPT as mm</p> <table border="1"> <thead> <tr> <th></th> <th>Increase</th> <th>increase as %</th> </tr> </thead> <tbody> <tr> <td>Southern</td> <td>4.3 - 4.4 cm</td> <td>2.5-2.6%</td> </tr> <tr> <td>Northern</td> <td>2.3cm</td> <td>1.29 or 1.3%</td> </tr> <tr> <td>Difference between N and S Europeans</td> <td>2 / 2.1 cm more for SE</td> <td></td> </tr> </tbody> </table>		Increase	increase as %	Southern	4.3 - 4.4 cm	2.5-2.6%	Northern	2.3cm	1.29 or 1.3%	Difference between N and S Europeans	2 / 2.1 cm more for SE		(3)
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2(c)(ii)	<ol style="list-style-type: none"> idea of change in diet or differences in diets between Northern and Southern Europeans ; difference in diet described, eg more protein ; idea of improved health care or better sanitation ; less effects of disease on growth / eq ; differences due to migration / eq ; idea of changes to gene pool as a result of migration ; 	<ol style="list-style-type: none"> ACCEPT idea of vaccinations 	(2)

Question Number	Answer	Additional guidance	Mark
3(a)	two recessive alleles / homozygous recessive / no allele for pigment ;	ACCEPT two lower case letters NOT homologous	(1)

Question Number	Answer	Additional guidance	Mark
3(b)(i)	colour of flowers ;	NOT white hydrangeas	(1)

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	<ol style="list-style-type: none"> 1. idea that at { low / acidic } pH more aluminium ions available ; 2. because the flowers are blue at low pH 3. the plant has taken up more aluminium ; 	1 ACCEPT converse for high pH	(3)

Question Number	Answer	Additional guidance	Mark
3(b)(iii)	<ol style="list-style-type: none"> 1. no pigment allele present / does not have the genotype for coloured flowers ; 2. idea that no pigment is present ; 3. idea that aluminium ions have no effect ; 	1. ACCEPT is homozygous recessive	(2)

Question Number	Answer	Additional guidance	Mark
3(c)	<ol style="list-style-type: none"> 1. multiple { alleles / genes } for a (single) characteristic ; 2. on more than one locus ; 3. idea of genes interacting ; 		(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	<ol style="list-style-type: none"> 1. identical twins (agreement) is greater / eq ; 2. credit correct manipulation of the data e. g. {41% more / 2.4x as much / 141% higher / eq} agreement than non-identical twins ; 3. idea that alleles are involved ; 4. idea that non-identical have genetic differences ; 5. idea that because less than 100% then some other factor is involved ; 	<p>ACCEPT converse where appropriate</p> <ol style="list-style-type: none"> 2. ACCEPT 41% difference 3. ACCEPT gene alternatives 3 and 4 IGNORE genes / DNA unqualified 4. ACCEPT identical twins are genetically the same 	(4)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	idea that there is less of a gap between the results ;	ACCEPT expressed as numbers, results similar (to each other), identical twin result is lower, non-identical higher	(1)

Question Number	Answer	Additional Guidance	Mark
4(b)	<ol style="list-style-type: none"> 1. idea that active areas have more {oxygen / oxygenated blood} ; 2. active areas involved in face recognition will be identified / eq ; 3. idea of level of brain activity between identical twins and non identical twins is compared ; 4. to offer supportive evidence / improve validity of study ; 5. idea that fMRI shows brain activity in real time ; 6. idea of high resolution ; 7. comment on safety / eq ; 	<ol style="list-style-type: none"> 3. areas more active / more oxygenated blood flowing to areas in identical twins compared with non-identical twins 3. idea of {more / eq} areas showing activity in common in identical twins than non-identical 5. IGNORE 3D image 6. ACCEPT more detail 7. fMRI does not use X rays 	(4)