Question Number	Answer	Additional Guidance	Mark
1(a)	**(QWC - Take into account quality of written communication when awarding the following points)** 1. Idea that in the rER insulin is folded e.g. forms {3-D shape, secondary / tertiary structure } ; 2. idea of insulin being packaged into (transport) vesicles by the rER ; 3. vesicles { move to / fuse with / eq } the Golgi apparatus / vesicles (fuse to) form the Golgi apparatus ; 4. idea of insulin being changed in Golgi apparatus ; 5. idea of insulin being transferred in (secretory) vesicles from the Golgi apparatus to the cell (surface) membrane ; 6. vesicles (containing insulin) fuse with cell (surface) membrane / exocytosis ;	**QWC emphasis on logical sequence** ACCEPT Golgi and protein instead of insulin 4.IGNORE folded, processed ACCEPT modified, described change e.g. add / remove sugars, glycosides, carbohydrate	**(4)**

Question Number	Answer	Mark
1(b)(i)	C unspecialised cells that can differentiate to give rise to almost any type of cell in the body, excluding totipotent cells ;	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. idea of stimulus e.g. chemical ; 2. idea that some genes are { active / switched on / expressed } ; 3. idea of { transcription / mRNA produced } at active genes ; 4. mRNA is {translated / used} to produce protein ; 5. idea that this protein modifies cell OR idea that this protein determines { cell structure / function } ;	2. IGNORE genes being 'turned on'	**(4)**

Question Number	Answer	Additional Guidance	Mark
2 (a)	1. enotype **AND** gametes of parents shown ; 2. genotypes of possible children correctly shown ; 3. genotypes clearly matched to phenotypes of possible children ; 4. (probability =) ¼ / 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
2 (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
2 (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
2 (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
2 (d)	1. idea that risk from gene therapy very small ;		
	2. idea that consequences of the disorder more certain than risks of the therapy ;	2. ACCEPT more benefits than risks / idea that severity of the disorder makes it worth the risk	
	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 ;	4. ACCEPT give the child a better quality of life / the best possible chance of a normal life / eq	
	5. idea that trial may lead to effective treatment e.g. could benefit others ;		**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)	1. idea of increasing cell number ; 2. idea of replacing { damaged / dead } cells OR idea of repairing (damaged) tissue ; 3. to produce <u>genetically</u> identical cells ;	1. ACCEPT 'production of new cells' and cells divide multiply or replicate 2. NOT growth or repair of cells	**(2)**

Question Number	Answer	Additional guidance	Mark
3(b)(i)	Stage 2. { hydrochloric / acetic / ethanoic } AND { macerate / soften / separate / break up / eq } ; Stage 3. Toluidine (blue) / orcein / Feulgen / Schiff's (reagent) ; Stage 4. Slide AND { coverslip / cover slide } ;	Stage 2. ACCEPT HCl, ACCEPT break down Stage 3. ACCEPT ethanoic /acetic / proprionic orcein. ACCEPT unambiguous spellings that couldn't be anything other than the name of a stain	**(3)**

Question Number	Answer	Additional guidance	Mark
3(b)(ii)	1. { safety goggles / safety glasses / gloves } when handling { acid / stain } 2. care (with scalpel) when cutting root tip 3. care with slide when squashing root tip ;	IGNORE lab coats protecting clothes	(1)

Question Number	Answer	Additional guidance	Mark
3(c)	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. idea of chemical stimulus e.g. signal protein, growth substance ; 2. idea of some genes {active / inactive / eq} ; 3. idea of transcription of active genes ; 4. mRNA translated / { polypeptide / protein } made / eq ; 5. idea of cell {structure / function} determined / cell modified e.g. lignin synthesised ;	QWC emphasis is logical sequence 1. A EPT hormone 2. ACCEPT ge s switched on / off 3. A EPT mRNA synthesised	(4)

Question Number	Answer	Additional guidance	Mark
3(d)(i)	chiasmata / pairing of homologous chromosomes / synapsis / formation of bivalents ;	IGNORE non-observable processes that are different ACCEPT crossing over ACCEPT spelling of chiasmata as chaismata or phonetically correct	(1)

Question Number	Answer	Additional guidance	Mark
3(d)(ii)	1. crossing over and { independent/ random} assortment ; 2. description of crossing over as swapping over sections of { chromatid / DNA } ; 3. description of independent assortment of maternal and paternal chromosomes ; 4. consequence described e.g. produces recombinants or new combinations of alleles ;	1. t s mark can be awarded if there are no correct details provided for either process	(2)

Question Number	Answer	Additional Comments	Mark
4(a)	1. idea of using part of the seedling ; 2. idea of using agar ; 3. (agar contains) growth substances / hormones / eq ; 4. Idea of using aseptic technique ; 5. Idea of covering the top of the container to prevent contamination OR loss of water ; 6. Idea of supplying light ; 7. allow a suitable length of time for growth e.g. 1 to 6 weeks ; 8. look for { roots / leaves / (complete) plant } forming ;	1. CCEPT cuttings, explants IGNORE cells unqualified 3. CCEPT named plant growth substance	**(4)**

Question Number	Answer	Additional Comments	Mark
4(b)(i)	1. percentage of seedlings (showing totipotency) decreases as age increases up to 21 days / negative correlation up to 21 days / eq ; 2. as age increases { after 21 / from 21-28 / at 28} days percentage of seedlings showing totipotency increases / eq ; 3. 28 days is an anomalous result ; 4. credit correct manipulation of the data ;	4. Some examples ar shown below <table><tr><td>Days</td><td>Difference (%)</td></tr><tr><td>7-28</td><td>(76-16</td></tr><tr><td>7-14</td><td>(76-20</td></tr><tr><td>*7-21 mp1*</td><td>(76-40) 36</td></tr><tr><td>14-21</td><td>(56-40) 16</td></tr><tr><td>*21-2 mp2*</td><td>(40-60) (+) 20</td></tr></table> IGNORE calculated percentage of percentage	**(2)**

Question Number	Answer	Additional Comments	Mark
4(b) (ii)	1. { repeats / larger number of seedlings } { at each age / in each group } / eq ; 2. more ages of seedlings used / use seedlings older than 28 days / test 35 day old seedlings / eq ; 3. repeat 28-day group / repeat any anomalous results / eq ;	1. ACCEPT repeated the whole experiment	**(2)**

Question Number	Answer	Additional Comments	Mark
4(c) (i)	as phenol concentration increases from { 7 to 21 / 7 to 14 / 14 to 21 } days, percentage of seedlings showing totipotency decreases / negative correlation up to 21 days / eq ;		**(1)**

Question Number	Answer	Additional Comments	Mark
4(c) (ii)	(as phenol concentration increases) at 28 days percentage of seedlings showing totipotency increases / eq ;	ACCEPT reference to after 21 days	**(1)**

Question Number	Answer	Additional Comments	Mark
4(d)	1. totipotent cells can { give rise to / differentiate to become } { any cell / extra embryonic tissues / eq } ; 2. pluripotent cannot { give rise to / differentiate to become } { all cells in the body / extra embryonic tissues / eq } ; 3. idea that only totipotent cells can give rise to other totipotent cells ; 4. idea that totipotent cells can give rise to an entire human being, pluripotent cells cannot ;	NOT 'turns into', 'becomes', 'develops into' but penalise once only 1. ACCEPT specialised for differentiated 1 & 2 IGNORE reference to embryonic cells/tissues unless it makes the response incorrect, ACCEPT placental cells/tissues 2. ACCEPT can give rise to most cells	**(2)**