Reproduction and Genetics - Mark Scheme

Q1.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • **Similarities (2)** - both involve vesicles (1) - both involve release of {chemicals / enzymes } by exocytosis (1) • **Difference (1)** (1) - acrosome reaction causes digestion of zona pellucida, cortical reaction causes thickening of zona pellucida	Allow description of exocytosis	**(3)**

Q2.

Question Number	Answer	Mark
	B – autosomal and linked	**(1)**

Q3.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to three of the following: • fusion of sperm cell (membrane) with egg cell membrane (1) • cortical granules release contents (into zona pellucida) (1) • contents of cortical granules react with the zona pellucida / zona pellucida { thickens / hardens } (1) • fusion of { sperm and egg / haploid } nuclei (1)	ALLOW sperm cell binds to egg cell membrane	3

Q4.

Question Number	Answer	Additional Comments	Mark
(a)	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. sperm cell {fuses / eq} with egg cell (*membrane*) ; 2. reference to {*cortical granules / vesicles / lysosomes*} ; 3. idea of (cortical granules) {moving towards / fusing with } egg cell (surface) *membrane* ; 4. reference to *exocytosis* (of *cortical granules / vesicles / lysosomes)* ; 5. idea of contents (of *cortical granules*) {secreted /released into jelly layer / eq} OR reference to *cortical reaction* ; 6. idea of { hardening / thickening / eq } of { *zona pellucida* / jelly layer } OR formation of *fertilisation membrane* ; 7. reference to change in charge across egg cell membrane ;	QWC emphasis is on spelling of technical terms 1. NOT the fusion of the nuclei 4. NOT for description of acrosome reaction 5. ACCEPT enzymes / chemicals NOT released into ovum 6. ACCEPT fertiliZation	**(4)**

Question Number	Answer	Additional Comments	Mark
(b)	1. reference to both { independent / random } assortment and { crossing-over/chiasma(ta) } ; 2. independent assortment gives rise to {new / different / eq} combinations of (paternal and maternal) chromosomes ; 3. crossing over involves swapping of {sections / eq} of {chromatids /chromosomes} ;	3. NOT swapping genes ACCEPT new combinations of alleles (on a chromosome) / recombinants	(2)

Question Number	Answer	Additional Comments	Mark
(c)(i)	1. Idea that temperature is a controlled variable e.g. constant temperature removes this variable, so temperature does not affect {results / length of pollen tube} ; 2. idea that (pollen tube) { growth / enzymes / proteins /eq } affected by temperature ; 3. idea that at this temperature { enzymes / proteins } will not be denatured / pollen not destroyed at this temperature / 22.5°C optimum temperature ; 4. idea that the investigation is valid ;	1. ACCEPT the idea of only changing one variable and keeping all the others constant – or so that only methylpurine affecting pollen tubes NOT 'a control' 4. NOT reliable IGNORE fair test, accurate, precise	(2)

Question Number	Answer	Additional Comments	Mark
(c) (ii)	1. idea of { no significant / small / 1mm / eq } increase in { mean length / growth } up to 0.0001 mol dm^{-3} ; 2. idea of negative correlation described e.g. {decrease in length of / shorter/ reduced growth of} pollen tubes as concentration increased OR over stated range from 0.0001 to 0.01 ; 3. idea of greatest { change / drop / eq } between 0.0010 and 0.0100 mol dm^{-3} / eq ; 4. credit correct manipulation of the data to illustrate decrease ;	IGNORE units. 2. ACCEPT reference to decreases at specific concentrations of methylpurine IGNORE negative correlation unqualified 3. NOT references to rapid decrease. 4. Some examples given below Conc. change / Difference (mm) / % all **decreases** *0.0000 – 0.0100 – mp2* / (94-28) 66 / 70 / 70.2 % 0.0001 – 0.0100 / (95-28) 67 / 71 / 70.5 % 0.0001 – 0.0010 / (95-90) 5 / 5 / 5.3 % *0.0010 – 0.0100 – mp3* / (90-28) 62 / 69 / 68.9 %	(3)

Question Number	Answer	Additional Comments	Mark
(c)(iii)	1. { less / no } transcription / idea of inhibition of RNA polymerase ; 2. { less / no } { translation / protein synthesis/ protein made / eq } ; 3. idea that protein needed for (pollen tube) growth e.g. less protein leads to reduced growth (of pollen tubes) ;	2 & 3 ACCEPT reference to enzyme instead of protein IGNORE repair	(2)

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	B (Q)		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	B (4 μm)		**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	B (haploid)		**(1)**

Q6.

Question Number	Answer	Mark
	C –ABc *The only correct answer is C* *A is not correct because B and C are on the same chromosome* *B is not correct because B and C are on the same chromosome* *D is not correct because b and c are on the same chromosome*	**(1)**

Q7.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	A		**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	D		**(1)**

Q8.

Question Number	Answer	Additional guidance	Mark
(a)	1. idea of more than one gene for a single characteristic ; 2. at different loci / eq ; 3. idea of giving rise to continuous variation ;	1. IGNORE alleles ACCEPT 'a phenotype' if specific	**(2)**

Question Number	Answer	Additional guidance	Mark
(b)	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 ;	1. ACCEPT deficiency 3. ACCEPT disease	(3)

Question Number	Answer	Additional guidance	Mark
(c)(i)	1. increased for { all / both Northern and Southern } Europeans / eq ; 2. greater increase for Southern Europeans than Northern Europeans / faster rate of increase for Southern Europeans ; 3. idea of greatest increase for Southern Europeans from 1970 to 1975 ; 4. idea of fall in height for Northern Europeans between 1970 and 1975 ; 5. manipulation of data to either show the increase of both or to show that the increase was greater for Southern Europeans than Northern Europeans ;	1. ACCEPT separate comments for North and South 2. ACCEPT converse Mp2 can also gain Mp1 if height referred to 5. ACCEPT as mm |	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)

Question Number	Answer	Additional guidance	Mark
(c)(ii)	1. idea of change in diet or differences in diets between Northern and Southern Europeans ; 2. difference in diet described, eg more protein ; 3. idea of improved health care or better sanitation ; 4. less effects of disease on growth / eq ; 5. differences due to migration / eq ; 6. idea of changes to gene pool as a result of migration ;	4. ACCEPT idea of vaccinations	(2)

Q9.

Question Number	Answer	Mark
	A the acrosome	(1)

Q10.

Question Number	Answer	Mark
	D to ensure that only one sperm fertilises the egg	(1)

Q11.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• genetic diagram to show that males can only inherit one of the fur colour alleles (1) An explanation that makes reference to the following: • tortoiseshell cats must have alleles for black and for orange fur (1) • males can only inherit one allele – either black or orange (1)	Accept appropriate symbols for the fur colour alleles as long as they are associated with the relevant sex chromosome Example of suitable diagram X^B / Y X^B: $X^B X^B$ / $X^B Y$ X^b: $X^B X^b$ / $X^b Y$	(3)