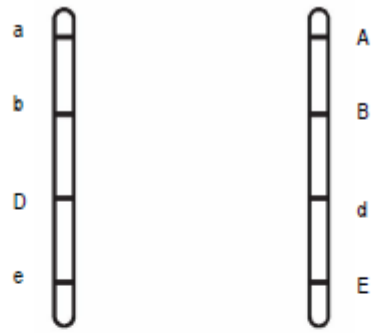
1)

(a) (i)	1. alleles ; 2. loci / locations / positions / eq ;	(2)
(a) (ii)	1. 174 (cm) ; 2. 172 (cm) ;	(2)
(b) (i)	1. {genotype / eq} ; 2. {environment / eq} ;	(2)
(b) (ii)	C ; A ; B ;	(3)

2)

(a)		(1)
(b) (i)	P = crista ; Q = matrix ; R = outer (mitochondrial) membrane / envelope / double membrane ;	(3)
(b)(ii)	1. (they carry out) (aerobic) respiration ; 2. provide {ATP / energy / eq} ; 3. to {move / drive the / eq} {flagellum / tail} ; 4. allows sperm to swim / eq ; 5. towards the {egg / eq} / {towards /along} the oviduct / eq ;	max (3)
(c)(i)	0.065 (%) ;;	(2)
(c)(ii)	16 ;	(1)

3)

(a)(i)	{α/ alpha} glucose ;	(1)
(a)(ii)QWC	(QWC - Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. made up of {many / eq} glucose (monomers) ; 2. reference to {energy / eq } storage / glucose is the respiratory substrate / synthesis of organic molecules / eq ; 3. idea that it is {large / eq} ; 4. so is un-reactive / insoluble /no osmotic effect ; 5. molecule coiling / compact / reference to amylose /eq ; 6. more can be stored (in available space) / eq ; 7. reference to branches / reference to (glycosidic) 1-6 bonds / amylopectin ; 8. {rapid / increased / eq } mobilisation of glucose units / eq ;	max (4)

(b)(i)	Allow converse 1. increase in temperature {decreases / eq } (the mean percentage of amylose present)/ negative correlation ; 2. but by differing percentages in all 3 varieties / C, then A & then B ; 3. credit correct manipulation of the data for 1 variety (e.g. by 4.0 % in variety A / 1.5% in variety B / 5% in variety C) eq ;	max (2)
(b)(ii)	1. (variety) B ; 2. idea of smallest difference between (means / amylose content) in B for the two different temp regimes ; 3. idea of {biggest error bars / widest spread} ; 4. idea that error bars for the 2 different temp regimes overlap ; 5. explanation of overlap e.g. some of the data for the lower temp falls within that of the higher temp ;	max (3)

4)

(a)(i)	1. line drawn correctly e.g. from pollen grain, down style to start of ovary ; 2. to micropyle (around the edge) ;	(2)
(a) (ii)	<table><tr><th>Labelled structure</th><th>Tick (✓) if chromosome number increases at fertilisation</th></tr><tr><td>A</td><td></td></tr><tr><td>B</td><td></td></tr><tr><td>C</td><td></td></tr><tr><td>D</td><td>✓</td></tr><tr><td>E</td><td>✓</td></tr></table> Comments given if more than 2 ticks and if use cross or crosses and ticks	(2)

(b)(i)	1. both {increase / positive correlation / eq} ; 2. (pollen tube) length (always) {greater/ eq} when boron present / eq ; 3. idea of rate of growth greater with boron ; 4. linear without boron (for 25 / 30 hours) and not linear with boron / eq ; 5. correct comparative manipulation of the data ;	max (3)
(b)(ii)	idea that pollen tube does grow even in the absence of boron ;	(1)
(b)(iii)	boron {increases / speeds up / eq} rate ;	(1)
(b)(iv)	1. more likely to reach the ovule /eq ; 2. fertilisation more likely to occur /eq ; 3. idea of fertilisation in shorter time period ;	max (2)

5)

(a)(i)	1. (increasing or doubling nitrate ion concentration) decreased mitosis / negative correlation / eq ; 2. manipulation of the data (e.g. by 6 cells (per 500 cells) / reduces by 24%) ;	(2)
(a)(ii)	1. only two concentrations were used / additional nitrate ion concentrations should be used ; 2. no {trend / eq} (as only 2 data sets) ; 3. If one of the two sets of data was {anomalous / eq} ; 4. reference to one with no nitrate ions present ;	max (2)
(a)(iii)	Two appropriate safety risks given ; ; One appropriate precaution, linked to one of the risks above ;	(3)

(b)	1. 3 + / sensible range of nitrate ion concentrations ; 2. reference to repeats (at each concentration) ; 3. reference to uniformity of seedlings (e.g. all from same parent plant, same age, same original root length) ; 4. idea that solution used should contain other mineral ions / named mineral ions ; 5. mention one other variable maintained / kept constant (e.g. temp, all run for same length of time, light intensity, volume of mineral solution) ; 6. reference to mechanism of judging root {growth /eq} (to measure optimum nitrate concentration) ;	max (3)

6)

(a)	1. A = rough endoplasmic reticulum / RER / rER ; 2. B = mitochondrion / mitochondria ; 3. C = nucleolus ;	(3)
(b)	G ;	(1)
(c)	C ;	(1)
(d)	<table><tr><th>Statement</th><th>Yes</th><th>No</th></tr><tr><td>The structure labelled D is present in both animal and plant cells</td><td>☒</td><td></td></tr><tr><td>The structure labelled E is the outermost layer in both animal and plant cells</td><td></td><td>☒</td></tr></table>	(2)

7)

(a) (i)	as a comparison / as a control / to show that it is {incubation temperature / not some other factor} affecting spindle fibre formation ;	**(1)**
(a) (ii)	1. as temperature increases (from 25°C) to 33°C the number of cells showing spindle fibre formation increases / positive correlation between 25°C and 33°C ; 2. as temperature increases from 33°C (to 37°C) there is no effect on number of cells showing spindle fibre formation / same values at 33°C and 37°C ; 3. credit correct manipulation of the data e.g. with a rise in temperature of 5°C (between 28 and 33°C) the number of cells showing spindle formation rises by 3 ;	**(2)**
(b) (i)	1. idea that (only) 35°C statement is supported ; 2. idea that data either side of 35°C both show all 5 (cells undergoing spindle fibre formation) ; 3. idea that only from 33°C do all 5 (cells show spindle fibre formation) ;	**(2)**
(b) (ii)	1. idea that 31°C statement may not be supported ; 2. idea that it could be between 2 and 5 ;	**(2)**

* (c) QWC	Take into account quality of written communication when awarding the following points. **Mark as pairs** 1. shape qualified e.g. hydrodynamic, streamlined ; 2. idea of reduced resistance ; 3. {*acrosome* / *vesicle*} containing {*enzyme* / *acrosin*}; 4. involved in {digestion / break down} of the {*zona pellucida* / jelly layer} ; 5. {*haploid* / eq} *nucleus* ; 6. allows restoration of {diploid / full complement / 46 / eq} *chromosomes* at *fertilisation* ; 7. *mitochondria* qualified e.g. large number, correct location ; 8. to supply {ATP / energy} for {movement / eq} ; 9. {*flagellum* / eq} present ; 10. for propulsion / swimming / motility / eq ; 11. {markers / receptors} in cell surface *membrane* ; 12. to bind to egg cell surface *membrane* / detect chemicals released by *ovum* / eq ;	**(6)**

8)

(a)	1. idea of half the number of chromosomes found in a {normal body cell/somatic cell / eq} ; 2. idea of containing one chromosome from each homologous pair; 3. the type of nucleus found in {gametes / sex cells / eq} ; 4. a nucleus is (an organelle / (double) membrane-bound structure / eq) ;	**(2)**
(b)	1. idea that pH increases then decreases; 2. correct manipulation of figures in an appropriate context e.g. overall 0.2 change / eq ;	**(2)**

Number		
* (c) QWC	**Take into account quality of written communication when awarding the following points.** 1. idea of amino acids transported to rER e.g. tRNA {binding to/ transporting} amino acids (in cytoplasm) ; 2. reference to involvement of ribosomes ; 3. amino acids {being joined by peptide bonds / forming polypeptide chains / forming primary structure of protein / eq} ; 4. {folded into 3-D shape / secondary or tertiary structure} in rER ; 5. packaged into vesicles at the end of the rER / eq ; 6. vesicles {move to / transported to / fuse with / eq} the Golgi apparatus ; 7. idea that protein modified in Golgi apparatus ; 8. (modified protein / enzyme / eq) packaged into (secretory) vesicles (by Golgi apparatus) eq ; 9. vesicles {move towards / fuse with} cell surface membrane / correct reference to exocytosis / eq ;	**(5)**
(d)	1. one (nucleus) fuses with the {egg nucleus / female gamete } / eq ; 2. one (nucleus) fuses with the (two) polar nuclei / eq ;	**(2)**