

- 1 (a) **MUST USE LABEL LINES**
ACCEPT NAMES AS WELL AS LETTERS
 S. – any point in the vagina
 D. – the cervix
 M. – the ovary
 F. – the oviduct
 E. – any point on the surface of the uterus or in cavity
 R if line is in muscular wall 5
- (b) (ovum)
 i. ref. to fallopian tube / oviduct ;
 ii. ref. to presence of ciliated cells / cilia (in wall) ;
 iii. ref. to (ovum) wafted down / propelled / moved / conveyed AW / sweep ; **R** passed unqual. **R** transport max 2
 iv. ref. to peristaltic movement AW of oviduct ;
- (ii) (sperm)
 i. ref. to presence of tail + to swim / move AW ;
 ii. ref. to mitochondria + to provide energy / power ;
 iii. ref. to sperm streamlined / light / very small ; 2
- (iii) (zygote)
 i. ref. to a fertilised egg / fused egg and sperm (nucleus) ;
 ii. contains chromosomes of egg and sperm ;
 iii. egg and sperm / gametes / sex cells + are both haploid / have half normal number of chromosomes / have 23 chromosomes / (both) formed by meiosis ; max 2
- (iv) ref. to progesterone ;
 secreted / produced by + placenta ; 2
- total max. 13**

2

- (a)(i) meiosis; (A) reduction division [1]
- (ii) ref. to half the number of chromosomes/haploid; (A) v.v has 23 chromosomes;
(A) only contains one sex chromosome AW
ref. to presence of tail/ability to move; (R) refs to shape
(A) less cytoplasm/less food stores AW max. [1]
- (iii) zygote; (A) diploid (R) [1]
- (iv) ref. to sperm cell that fertilises it must be carrying an X (chromosome);
ref. to fertilised egg cell contains XX;
(A) egg cell had not been fertilised by a Y sperm AW [1]
- (b)(i) ovary; (A) follicle [1]
- (ii) oviduct/fallopian tube; [1]
- (iii) uterus; (A) womb [1]
- (c) (amniotic fluid)
- protects fetus from physical damage/cushions; (R) protects unqual.
 - acts as shock absorber AW ; (R) prevents shock unqual.
(R) supports unqual.
 - prevents unequal pressures from acting on fetus/maintains constant environment/allows free movement;
 - protects fetus from temperature fluctuations AW; (R) insulates unqual.
 - protects fetus from drying out AW;
 - ref. to absorbs + excretory material/urine from fetus; max. [1]
- (amniotic sac)
- secretes/produces + amniotic fluid;
 - encloses/contains + amniotic fluid AW; max. [1]
- (d)(i) IGNORE REFS TO NUTRIENTS/FOOD
- ref. to exchange of up to two named materials e.g. oxygen/glucose/water/amino acids/antibodies/urea/carbon dioxide; ;
(A) other correct materials ()
 - ref. to physical attachment between fetus and uterus/mother;
 - ref. to prevention of blood mixing/allows blood systems to be close AW;
 - ref. to protection from mother's (high) blood pressure;
 - ref. to protective role in preventing the entry of some pathogens AW;
(R) germs/disease max. [4]
- (ii) ref. to secretion of progesterone; (ignore oestrogen refs.)
to keep lining of uterus thick/prevents menstruation/to prevent breakdown of uterus lining;
(A) prevents uterine muscle contracting [2]

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Total 15
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- 3 (a) column drawn and shaded correctly ;
Y axis labelled ;
X axis labelled + units ; [3]
- (b) continuous ; [1]
- (ii) ref. to different amounts of light ; ® environmental differences unequal.
ref. to different amounts of minerals ;
ref. to exposure to different temperatures ;
ref. to disease / fungal or viral infection ;
ref. to competition for water ;
ref. to genetic differences ;
ref. to trampling ;
ref. to grazing ; [max. 3]
- (c) ref. to large + petals ;
ref. to coloured + petals ;
ref. to scent ;
ref. to presence of nectar ; [max. 2]
- (ii) ref. to pollination AW ; [1]
- (d) ref. to self-pollination / ref. to other agents of pollination ;
so fertilization occurs using pollen from same flower AW ; [2]
- [max.12]

Question		Mark	Additional Guidance																								
4 (a)	feathers ;	max [1]																									
(b)	<table border="1"> <tbody> <tr> <td data-bbox="338 353 660 420">go to 2</td> <td data-bbox="660 353 792 420"></td> </tr> <tr> <td data-bbox="338 420 660 486">go to 4</td> <td data-bbox="660 420 792 486"></td> </tr> <tr> <td data-bbox="338 486 660 553"><i>Spinus tristis</i></td> <td data-bbox="660 486 792 553">D</td> </tr> <tr> <td data-bbox="338 553 660 619">go to 3</td> <td data-bbox="660 553 792 619"></td> </tr> <tr> <td data-bbox="338 619 660 686"><i>Ara ararauna</i></td> <td data-bbox="660 619 792 686">A</td> </tr> <tr> <td data-bbox="338 686 660 752"><i>Aquila chrysaetos</i></td> <td data-bbox="660 686 792 752">F</td> </tr> <tr> <td data-bbox="338 752 660 819"><i>Platalea regia</i></td> <td data-bbox="660 752 792 819">C</td> </tr> <tr> <td data-bbox="338 819 660 886">go to 5</td> <td data-bbox="660 819 792 886"></td> </tr> <tr> <td data-bbox="338 886 660 952"><i>Trochilus polytmus</i></td> <td data-bbox="660 886 792 952">E</td> </tr> <tr> <td data-bbox="338 952 660 1019">go to 6</td> <td data-bbox="660 952 792 1019"></td> </tr> <tr> <td data-bbox="338 1019 660 1109"><i>Recurvirostra americana</i></td> <td data-bbox="660 1019 792 1109">G</td> </tr> <tr> <td data-bbox="338 1109 660 1176"><i>Phoenicopterus minor</i></td> <td data-bbox="660 1109 792 1176">B</td> </tr> </tbody> </table>	go to 2		go to 4		<i>Spinus tristis</i>	D	go to 3		<i>Ara ararauna</i>	A	<i>Aquila chrysaetos</i>	F	<i>Platalea regia</i>	C	go to 5		<i>Trochilus polytmus</i>	E	go to 6		<i>Recurvirostra americana</i>	G	<i>Phoenicopterus minor</i>	B	[3]	5 or 6 correct = 3 3 or 4 correct = 2 1 or 2 correct = 1
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Question		Mark	Additional Guidance
4 (c) (i)	A – meiosis ; B – zygote ;	[2]	
(ii)	(cell/nucleus) has <u>two</u> sets of chromosomes ; has pairs of chromosomes ; has chromosomes from <u>two</u> , haploid cells/sperm and egg/two gametes ; has chromosomes from male and female (parents) ; has twice the number of chromosomes as the gametes ;	max [1]	ignore has 80 chromosomes ignore 2n unqualified
(iii)	increase in complexity ; (named) cells/tissue(s)/organ(s)/organ system(s), become specialised/differentiate/AW ;	max [1]	R ref to increase in cell number and cell size
(iv)	ref adaptation to, new/changed, environment/habitat/ecosystem ; any example ; e.g. ref to (new) disease/camouflage/escaping from (new) predators allows, selection/evolution ; ref to reduces competition ; increases chances of survival of the species/reduces chance of extinction ; AVP ; e.g. increase in gene pool	max [2]	A ref to selective advantage
		[Total: 10]	

5 (a)	<p>taking a, gene/DNA/allele, from one species ; inserting it into another organism ;</p> <p>OR</p> <p>changing the, genetic material/chromosome of, an organism/cell ; by removing/changing/inserting, <u>genes</u>/<u>DNA</u>/<u>alleles</u> ;</p>	max [2]																						
(b)	<table border="1"> <thead> <tr> <th data-bbox="398 435 557 503">Letter from fig</th> <th data-bbox="557 435 801 503">Name</th> <th data-bbox="801 435 1270 503">Descrip</th> </tr> </thead> <tbody> <tr> <td data-bbox="398 503 557 579">M</td> <td data-bbox="557 503 801 579">chromosomes</td> <td data-bbox="801 503 1270 579">threads of DNA found in the nucleus</td> </tr> <tr> <td data-bbox="398 579 557 654">N</td> <td data-bbox="557 579 801 654">gene/allele ;</td> <td data-bbox="801 579 1270 654">section of DNA removed from human cell</td> </tr> <tr> <td data-bbox="398 654 557 858">Q</td> <td data-bbox="557 654 801 858">plasmid</td> <td data-bbox="801 654 1270 858">vector / loop/circle, of DNA (that can carry a foreign section of DNA) / separate piece of DNA (from chromosome) ;</td> </tr> <tr> <td data-bbox="398 858 557 934">R</td> <td data-bbox="557 858 801 934">bacterial (cell) ; A yeast</td> <td data-bbox="801 858 1270 934">type of cell that is genetically engineered</td> </tr> <tr> <td data-bbox="398 934 557 1040">O</td> <td data-bbox="557 934 801 1040">insulin/protein ;</td> <td data-bbox="801 934 1270 1040">specific chain of amino acids coded by the section of DNA removed from the human cell</td> </tr> <tr> <td data-bbox="398 1040 557 1236">P</td> <td data-bbox="557 1040 801 1236">fermenter</td> <td data-bbox="801 1040 1270 1236">(container in which) bacteria/microorganisms/cells, reproduce/grow/produce insulin ;</td> </tr> </tbody> </table>	Letter from fig	Name	Descrip	M	chromosomes	threads of DNA found in the nucleus	N	gene/allele ;	section of DNA removed from human cell	Q	plasmid	vector / loop/circle, of DNA (that can carry a foreign section of DNA) / separate piece of DNA (from chromosome) ;	R	bacterial (cell) ; A yeast	type of cell that is genetically engineered	O	insulin/protein ;	specific chain of amino acids coded by the section of DNA removed from the human cell	P	fermenter	(container in which) bacteria/microorganisms/cells, reproduce/grow/produce insulin ;	[5]	
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5 (c)	<p>clone / (genetically) identical ; rapid / less energy to reproduce (asexually) / only one parent / no gametes ; large quantity of insulin produced ; all bacteria, have the insulin gene / produce insulin ; same insulin produced ; once cells are engineered does not have to be repeated ; AVP ; e.g. cheap / ethical <i>or</i> religious reasons / less allergic reaction / no immune rejection / more efficient / no risk of disease (transmission)</p>	max [3]	<p>A <u>no</u> variation</p> <p>only accept in context of comparisons with animal insulin extraction methods</p>
		[Total: 10]	

Question	Answers	Marks	Additional Guidance
6 (a)	pollen transferred from, anther / stamen, to stigma ; within same <u>flower</u> / between <u>flowers</u> on same plant ; R if only 'same plant'	[2]	R complete answers given in context of fertilisation R 'single parent'
(b)	<p><i>cross 1</i></p> $I^R I^R \times I^W I^W$ $I^R + I^W$ $I^R I^W ;$ <p><i>cross 2</i></p> $I^R I^W \times I^R I^W$ $I^R, I^W + I^R, I^W ;$ $I^R I^R, I^R I^W, (I^R I^W), I^W I^W ;$ <p>1 <u>red</u> : 2 <u>pink</u> : 1 <u>white</u> ; A 25% red : 50% pink : 25% white A multiples, e.g. 2 red : 4 pink : 2 white</p> <p>R if two different ratios given</p>	[4]	<p>A other notation, e.g. R and r or mixture, e.g. I^R and I^W. R I^{RR}, etc.</p> <p><i>cross 1</i> 1 mark for parental genotypes, gametes and offspring all correct. Any mistake and no mark awarded.</p> <p><i>cross 2</i> 1 mark for cross genotypes and gametes all correct. Any mistake and no mark awarded.</p> <p>1 mark for giving all three genotypes (on answer line or in the white space e.g. in Punnett square). If correct on answer line ignore any errors in working.</p> <p>1 mark for ratio of offspring phenotypes and colours R if no colours given</p>
(c)	$I^R I^W \times I^W I^W$ $I^R, I^W + I^W ;$ $I^R I^W, I^W I^W ;$ <p>1 (pink) : 1 (white) ; R if two different ratios given</p>	[3]	<p>1 mark for parental genotypes and gametes all correct. Any mistake and no mark awarded.</p> <p>1 mark for offspring genotypes</p> <p>1 mark for ratio (colours not necessary) A if no colours given</p>

Question	Answers	Marks	Additional Guidance
6 (d)	<p>1 ref. to meiosis ;</p> <p>2 mutation can occur <u>in meiosis</u> ;</p> <p>3 (gives) variation / diversity ; R 'varied species (plural)'</p> <p>4 ref. to, alleles / genes / DNA, from different, plants / parents ;</p> <p>5 allows mutations to be, expressed / AW ;</p> <p>6 allows adaptation to, new conditions / changed environment / AW ;</p> <p>7 (new species) can evolve / allows natural selection to occur ;</p> <p>8 seeds are dispersed ; R dispersed unqualified, R pollen dispersal</p> <p>9 can colonise new areas / AW ;</p> <p>10 less competition (with parent plant / among offspring) ;</p>	[max 4]	<p>R sexual reproduction allows mutations to occur</p> <p>A may allow resistance to disease A 'suited to' / survive / AW for adapted</p> <p>R 'passed on by natural selection' R 'new species are made'</p> <p>A 'go to new areas' or 'spread to new areas'</p> <p><i>competition is in context of seed dispersal not pollen dispersal</i></p> <p>R 'multiply quicker'</p>
[Total: 13]			