16. Reproduction

16.4 Sexual reproduction in humans

Paper 3 and 4

Marking Scheme

Q1.

(a)	**U** ; **S / T** ; **T** ; **R** ;	**4**	

Q2.

(a)	<table><tr><th>name of the part</th><th>letter in Fig. 7.1</th><th>function</th></tr><tr><td>uterus</td><td>**A** ;</td><td>where the fetus grows</td></tr><tr><td>oviduct ;</td><td>**E** ;</td><td>where fertilisation occurs</td></tr><tr><td>ovary ;</td><td>**D**</td><td>maturation / release, of egg (cells) ;</td></tr></table>	**5**	

Q3.

(b)	*any two from:* vagina ; uterus ; oviduct ; ovary ; cervix ;	**2**	

Q4.

(a)	*acrosome:* contains / releases, enzymes ; digests jelly coat ; (so) sperm nucleus can reach egg cell nucleus ; *mitochondria :* correct ref. to (aerobic) respiration ; correct ref. to energy release ; to, swim to / reach, the egg cell ;	**4**	
(b)	<table><tr><th>feature</th><th>egg cell</th><th>sperm cell</th></tr><tr><td>relative size</td><td>large(r)</td><td>small(er)</td></tr><tr><td>motility</td><td>non-motile / cannot move / AW</td><td>motile / swims</td></tr><tr><td>numbers produced</td><td>idea of few / fewer</td><td>idea of many / more / millions</td></tr></table> ;;;	**3**	one mark for each correct row
(c)	76.7(%) ;;;	**3**	**MP1** for correct conversion 1.5 million to 1 500 000 **or** 350 000 to 0.35 **MP2** correct answer calculated as 76.66666 recurring from (1 500 000 – 350 000 or 1 150 000) ÷ 1500 000 × 100 or (1.5 – 0.35 or 1.15) ÷ 1.5 × 100 **MP3** correct rounding to one decimal place ecf from previous step

(d)(i)	amniotic sac ;	**1**	
(d)(ii)	**R**: connects, placenta / mother, to fetus OR transfer substances between, placenta / mother, and fetus ; **S**: protection / cushioning / shock absorber / AW ;	**2**	
(d)(iii)	*any two from:* gas exchange ; transfer / provide, of (named) nutrients ; transfer of waste ; AVP ;;	**2**	e.g. separates maternal and fetal blood / ref. to (named) pathogen or toxin

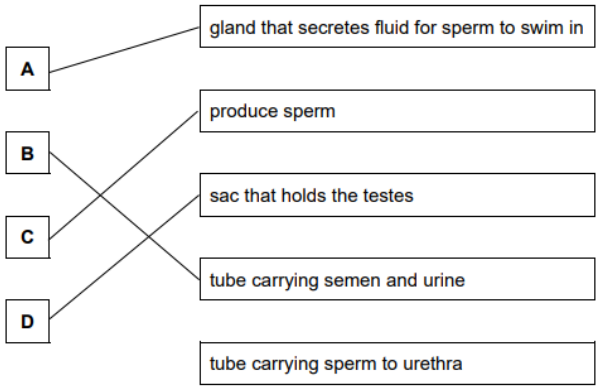
Q5.

<table>
<tr><td>(a)(i)</td><td>
<table>
<tr><th>letter from Fig. 3.1</th><th>name</th><th>function</th></tr>
<tr><td>V</td><td>sperm duct ;</td><td>carries sperm away from the testis</td></tr>
<tr><td>Z ;</td><td>urethra</td><td>carries urine and sperm out of the body</td></tr>
<tr><td>Y</td><td>penis ;</td><td>deposits sperm into the vagina</td></tr>
<tr><td>T ;</td><td>prostate gland</td><td>makes the fluid for the sperm to swim</td></tr>
<tr><td>W</td><td>scrotum</td><td>hold the testes outside of the body / keep testes cool ;</td></tr>
<tr><td>X</td><td>testis</td><td>produce, sperm / testosterone ;</td></tr>
</table>
</td><td>6</td><td></td></tr>
<tr><td>(b)(i)</td><td>
<table>
<tr><td>L</td><td>M</td><td>K ;</td><td>J ;</td><td>H</td><td>G ;</td></tr>
</table>
</td><td>3</td><td>one mark M then K after L
one mark J in middle
one mark H then G at the end</td></tr>
<tr><td>(b)(ii)</td><td>X or Y ;</td><td>1</td><td></td></tr>
</table>

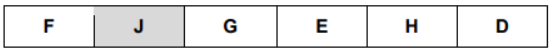
Q6.

(a)(i)	ovary circled ; **W** written (with a label line ending) on an oviduct ; **X** written (with a label line ending) inside the, uterus / uterus lining ;	3	
(a)(ii)	meiosis ;	1	
(a)(iii)	*any two from:* vagina ; cervix ; uterus ; oviduct ;	2	

Q7.

(a)	 ;;;;	4	one mark for each correct line **R** each additional line
(b)(i)	egg cell / ovum / ova ;	1	
(b)(ii)	zygote ;	1	
(b)(iii)	oviduct ;	1	

Q8.

(a)(i)	tick in the box next to 'a ball of cells' ;	1	**R** additional ticks
(a)(ii)	 ;;;	3	one mark for **F** at the start and **D** at the end one mark for **G** before **E** one mark for **E** before **H**
(b)	uterus wall ; cervix ; amniotic sac ; vagina / cervix ; umbilical cord ; afterbirth ;	6	

Q9.

(a)	**X** – oviduct ; **Y** – uterus ; **Z** – cervix ;	3	

Q10.

(a)	*any two from:* flagellum ; ref. to enzymes ; AVP ;	**2**
(b)	*any two from:* ref. to sperm and egg / male and female gametes ; fusion of nuclei ; AVP: e.g. ref to enzymes dissolving jelly layer / change in jelly coat once one sperm has entered / AW	**2**

(c)

C	amniotic fluid	protects fetus from mechanical damage / maintains temperature / fetal drinking ;
E ;	cervix ;	dilates during birth
A	placenta	supplies, nutrients / removes waste / acts as a barrier against toxins or pathogens ;
F	umbilical cord	transfers (named) substances between, mother/placenta, and fetus ;
B ;	uterus wall	contracts during birth

6

Q11.

(a)	**E** ; **C** ; **B** ; **C** ; **A** ;	**5**
(b)	energy ; jelly ; fertilisation ;	**3**
(c)(i)	mouse ;	**1**
(c)(ii)	43 (µm) ;	**1**
(d)	horse ;	**1**

Q12.

(c)	to swim, faster / further ;	**1**	
(d)	testis ;	**1**	

Q13.

(a)	testis / testes ; ovary / ovaries ;	**2**	
(b)(i)	***P*** egg cell / ovum / ova ; ***Q*** sperm ; ***S*** zygote / fertilised egg cell ;	**3**	
(b)(ii)	***P*** X ; ***Q*** X ; ***S*** XX ;	**3**	
(b)(iii)	***R*** fertilisation ; ***T*** mitosis ;	**2**	
(b)(iv)	uterus ;	**1**	

Q14.

(a)	<table><tr><th>name of part</th><th>letter in Fig. 4.1</th><th>function</th></tr><tr><td>amniotic sac</td><td>**E** ;</td><td>contains amniotic fluid</td></tr><tr><td>cervix ;</td><td>**D** ;</td><td>dilates during birth</td></tr><tr><td>umbilical cord ;</td><td>**F** ;</td><td>carries materials between mother and fetus</td></tr></table>	**5**	
(b)	zygote ; grows / divides ; reference to mitosis ; forms a ball of cells ; becomes an embryo ;	**3**	
(c)	early stage increases in complexity ; late stages increases in size ;	**2**	

Q15.

<table>
<tr><td>(a)</td><td>C ;
B ;
A ;</td><td>3</td><td></td></tr>
<tr><td>(b)(i)</td><td>ovary ;</td><td>1</td><td></td></tr>
<tr><td>(b)(ii)</td><td>in plasma / in the blood ;</td><td>1</td><td></td></tr>
<tr><td>(c)(i)</td><td><table>
<tr><th>sexual secondary characteristic</th><th>boy</th><th>girls</th></tr>
<tr><td>breasts grow</td><td></td><td>✓</td></tr>
<tr><td>growth of sex organs</td><td>✓</td><td>✓</td></tr>
<tr><td>growth of pubic hair</td><td>✓</td><td>✓</td></tr>
<tr><td>start of menstruation</td><td></td><td>✓</td></tr>
<tr><td>voice deepens</td><td>✓</td><td></td></tr>
</table>;;;;</td><td>4</td><td>1 mark for each correct row

I tick in girls</td></tr>
</table>

Q16.

(a)(i)	zygote ;	**1**	
(a)(ii)	fertilisation ;	**1**	
(a)(iii)	oviduct ;	**1**	

Q17.

<table>
<tr><td>(b)(i)</td><td><table>
<tr><th>letter</th><th>name of tube</th><th>name of substance or substances transported</th></tr>
<tr><td>A</td><td>rectum / colon / large intestine ;</td><td>faeces</td></tr>
<tr><td>B</td><td>sperm duct ;</td><td>sperm</td></tr>
<tr><td>C</td><td><u>urethra</u> ;</td><td>sperm and urine</td></tr>
<tr><td>D</td><td><u>ureter</u> ;</td><td>urine</td></tr>
</table></td><td>4</td><td></td></tr>
<tr><td>(b)(ii)</td><td>line labelled P ending on prostate gland ;</td><td>1</td><td></td></tr>
<tr><td>(c)</td><td>protects / holds / contains, testis
or
idea of maintains testes at <u>lower</u> temperature (than that of body) ;</td><td>1</td><td></td></tr>
</table>

Q18.

(a)	**C** ; **E** ; **B** ;	**3**	
(b)	sperm is, deposited / AW, in the vagina ; (travels) through, cervix / uterus ; to oviduct ;	**3**	

Q19.

(c)

function	letter from Fig. 5.2	name
dilates in the process of birth / AW / AVP	**M**	cervix
release / production, of oestrogen / egg / ovum / ova / (female) gametes / AVP	**L**	ovary
site of fertilisation	**J**	oviduct
site of implantation	**P**	uterus (lining)

;;;;

4 one mark for each correct row

(d)(i)	*any four from:* 1 gas exchange / oxygen transfers to fetus / oxygen transfers from mother / carbon dioxide transfers to mother / carbon dioxide transfers from fetus ; 2 transfers of (dissolved) nutrients, from maternal / to fetal (circulation); 3 transfer of excretory products, from fetal / to maternal (circulation) ; 4 (transfer of nutrients / excretory products) by diffusion ; 5 (placenta) produces / secretes, (named) hormone ; 6 transfer of antibodies, from maternal / to fetal (circulation) OR passive immunity provided (to fetus) ; 7 (placenta) separates fetal and maternal blood supply ; ora 8 AVP ;	**4**	
(d)(ii)	*any two from:* 1 provides support to fetus ; 2 protect fetus from (mechanical) shock ; 3 maintains temperature (of fetus) / AW ; 4 allows movement (of fetus) / allows for development of bones and muscles / lubricant ; 5 maintains osmotic balance / prevents dehydration ; 6 ref. to swallowing of (amniotic) fluid / involved in digestive tract development / involved in lung development ; 7 provides sterile environment ;	**2**	

Q20.

(c)	*any three from:* flagellum ; (many) mitochondria ; acrosome (containing enzymes) ; haploid (nucleus) / AW ;	**3**	

Q21.

(a)	**P** – testis ; **S** – zygote ; **Q** – meiosis ; **R** – fertilisation ; **T** – mitosis ; **U** – implantation ;	**6**	
(b)(i)	*idea of* maintenance of the same number of chromosomes (from generation to generation) / so (diploid) number of chromosomes does not double at fertilisation (described) ;	**1**	
(b)(ii)	to prevent more than one sperm fertilising the egg / stops other sperm entering ;	**1**	
(c)	1 diffusion / exchange ; 2 amino / fatty ; 3&4 ;; *max. two from:* glucose (named) vitamins (named) minerals / ions / salts glycerol fatty acids amino acids 5 passive ; 6 antigens ; 7 pathogen / (micro)organism ;	**7**	**A** fatty acids or amino acids only once, i.e. MP2 OR MP3/4

Q22.

(a)	lumen or wall of left or right oviduct labelled **Q** ; area of uterus with darkest shading labelled **R** ; ovary labelled **S** ; vagina labelled **T** ;	**4**	
(b)(i)	*any three from:* ref. to making new cells after fertilisation ; making membranes ; (protein for) making enzymes ; making new, (named) cell structures / cytoplasm ; (fat / protein) provide / source of, energy ; energy for, cell division / mitosis / growth (of cell) / metabolism / AW ;	**3**	
(b)(ii)	*any two from:* hardens / changes, after fertilisation / entry of sperm ; prevents more sperm entering ; AVP ;	**2**	
(c)	*any four from:* chromosomes / DNA, duplicate(s) / replicate(s) ; chromosomes separate ; mitosis / nuclear division ; (zygote / fertilised egg) divides / splits (into two) ; (nuclear / cell) division / mitosis, repeated / AW ; forming a, ball / cluster, of cells ; cells are genetically identical ; AVP ; e.g. cell, specialisation / differentiation / ref. to stem cells	**4**	

Q23.

(b)	**1** sperm / male gametes are, deposited in, **S** / vagina OR travel through, **R** / cervix ; **2** egg / sperm / gametes, travel, to **P** / oviduct ; **3** enzymes (from acrosome / sperm) digest jelly coat (around egg) ; **4** fertilisation OR fusion of <u>nuclei</u>, of sperm / male gamete, and of female gamete / egg (cell) ; **5** formation of <u>diploid</u> zygote ; **6** zygote / embryo, travels, down **P** / oviduct OR zygote / embryo, travels to, **T** / uterus ; **7** mitosis / cell division / growth / develop (zygote / embryo / fetus) ; **8** ball of cells / embryo, implants in, **T** / uterus ; **9** **U** / placenta / **V** / umbilical cord (between mother, and fetus) ; **10** delivery / diffusion, of (named) resource / excretion of (named) waste, via **U** / placenta / **V** / umbilical cord ; **11** AVP ; e.g. • named sperm adaptation for swimming e.g. mitochondria • **Q** / ovary / **U** / placenta, releases progesterone (to maintain lining) • *ref to* (cell) specialization / complexity, of fetus / (named) organs (in fetus)	**6**	

Q24.

(a)	embryo ;	1
(b)	*any two from:* growth in all stages ; development during all stages ; (more) increase in complexity in early stages ; (more) increased in size in later stages ;	2

(c)	*any four from:* maintains temperature ; (mechanical) protection ; provides support (of the fetus) ; provides a sterile environment / prevents infections ; allows movement (of the fetus) ; (movement) allows for development of bones and muscles ; ref. to swallowing (of fluid) ; lubrication / AW ; AVP ;	4

Q25.

(c)

	similarities		differences A ora
1	treatment with fertility drugs ;	10	ovulation occurs in AI ;
2	(fertility drugs) encourage, follicle production / egg development ;	11	fertilisation in AI occurs inside the body / in IVF it occurs in, a Petri dish *or* outside the body *or* AW ;
3	intercourse does not occur ;	12	eggs removed (from ovary) in IVF ;
4	collection of sperm (from a donor) ;	13	embryo starts development outside body in IVF / embryo inserted into uterus in IVF ;
5	washing of sperm ;	14	excess / surplus, embryos produced in IVF ;
6	fertilisation *or* fusion of, gametes / egg and sperm ;	15	embryo selection possible in IVF ;
7	lining of uterus must develop ;	16	frozen / stored, embryos in IVF ;
8	implantation occurs (naturally) ;		
9	**A** *as a similarity or as a way IVF differs from AI* increase chances of multiple, births / babies ;		

6

Q26.

(b)

name of structure	function	letter on Fig. 4.1
testis	production of sperm / produces *or* releases testosterone	**C** ;
sperm duct	transports sperm but not urine	**D** ;
urethra	passage for urine and seminal fluid through the penis	**A** ;
prostate gland	secretes / produces, seminal fluid / nutrient-rich fluid / alkaline fluid / AW	**E** ;
scrotum / scrotal sac	contains testes	**B** ;

5 one mark per row

Q27.

(c)(i)

letter	name	function
P	acrosome	contain enzymes / digests jelly coat ;
Q	haploid nucleus	contains / AW, DNA / half number / unpaired, single set of / chromosomes / genes ;
R	mitochondrion ;	releases energy
S	flagellum	swimming / AW ;

4 one mark per row

(d)

drawing detail ;
additional drawing detail / any drawn and labelled common cell structure e.g. nucleus, cytoplasm, cell membrane, mitochondria / DNA / ribosome / (r)ER ;
drawn and labelled unique cell structure ; e.g. jelly (coat) / energy store / protein-rich layer / yolk / large volume of cytoplasm

3

(e)

jelly coat (of fertilised egg) hardens ;
reference to zygote ;
mitosis / cell division ;
embryo forms ;
moves down oviduct ;
AVP ; e.g. use of nutrients in cytoplasm

3

Q28.

(a)(i)	<table><tr><td>process / event</td><td>letter from Fig. 6.1</td></tr><tr><td>meiosis</td><td>**R** ;</td></tr><tr><td>fertilisation</td><td>**S** ;</td></tr><tr><td>implantation</td><td>**V** ;</td></tr></table>	**3**	

(a)(ii)	oviduct ;	**1**	

(d)	*flagellum* (flagellum) propels the sperm ; to, oviduct / site of fertilisation / egg (cell) / ovum ; *mitochondria* aerobic respiration ; provides / releases / supplies, energy / ATP ; *acrosome* (contains / has / releases) enzyme(s) ; (enzymes) digest / break down / dissolve, jelly coat / protein layer ; so sperm nucleus can enter the egg cell / so sperm and egg membranes can fuse together ;	**6**	**A** flagellum allows sperm to swim **R** 'produces energy'
(e)	*idea that* sex is determined by X and Y chromosomes / males are XY and females are XX ; egg cells have X chromosome / females can only provide X chromosome ; sperm cells have X or Y chromosome / only the males can provide X or Y chromosome / only males can provide the Y chromosome ;	**2**	