Q1.

6 (a) A – germinal epithelium ;
B – Graafian follicle ; [2]

(b) (i) primary oocyte ; [1]

(ii) label to primary oocyte on Fig. 6.2 ; [1]

(iii) P - mitosis
Q - meiosis ; *both required for mark* [1]

(c) *either*
independent assortment ;
homologous / maternal and paternal, chromosomes position themselves either way up / AW ;
on equator (of spindle) ;
so segregate randomly / any combination of maternal and paternal chromosomes can end up in daughter cells ;
AVP ; e.g. occurs during metaphase 1
or
crossing over / chiasmata ;
between, chromatids of homologous chromosomes / non-sister chromatids ;
genetic material on maternal and paternal chromosomes swap places / AW ;
leads to new combination of alleles ; **R** genes
AVP ; e.g. breaking established linkage groups / occurs during prophase 1 [3 max]

[Total: 8]

Q2.

4 (a) 1 depolarisation / impulses / action potential, opens calcium ion channels ;
A increased permeability to calcium ions
2 in presynaptic membrane ;
3 calcium ions enter, synaptic knob / through presynaptic membrane ;
4 vesicles of, acetylcholine / neurotransmitter ;
5 fuse with presynaptic membrane ;
6 empty contents into synaptic cleft / exocytosis ; [3 max]

(b) (i) 1 fluorescence, more / higher, in sperm from wild type mice / ora ;
2 comparative figures ; e.g. 170 v 10 **and** 400 v 10
3 mutant sperm do not have **P** / ora ;
4 so cannot take up calcium ions / ora ; [3 max]

(ii) 1 fluorescence of flagella (of wild-type sperm) higher than heads ;
2 more **P** in flagellum than head ;
3 flagella take up more calcium ions ;
4 flagellum has larger surface area / ora ;
5 no difference in heads and flagella of mutant mice sperm since no **P** ; [3 max]

(c) (i) fertilisation, in glass / in a dish ; **R** "test tube baby" unexplained
outside the reproductive tract / outside the body ; [2]

(ii) *with ZP*
1 few / no, mutant sperm penetrate zona pellucida / ora ;
2 lack of calcium ions / ora ;
3 no / less, vigorous movement (of flagellum) / ora ;

without ZP
4 mutant sperm can penetrate oocytes (without ZP) ;
5 differences in penetration less significant between wild type and mutant ;
6 flagellum movement not needed for penetration (of oocyte membrane) / AW ;
7 AVP ; e.g. smaller % success of wild-type sperm with oocytes without ZP compared with wild with ZP because, lack of binding site / damage to oocyte [4 max]

[Total: 15]

Q3.

2 (a) *oestrogen*
follicle (cells) / granulosa (cells) / theca ;

progesterone
corpus luteum ; **A** follicle (cells) [2]

(b) 1 (oestrogen / progesterone affect) hypothalamus / <u>anterior</u> pituitary ;
2 inhibit secretion of, FSH / LH / GnRH ;
3 follicles do not develop ;
4 no ovulation ; **R** ref to eggs
5 ref. negative feedback ;
6 alters <u>cervical</u> mucus to stop sperm ;
7 prevents implantation / effect on endometrium ; **R** endometrium thickens [4 max]

(c) *any two from*

1 (advantage of smaller population), less poverty / less starvation / less disease ;

2 greater care for children that are born ;

3 (benefit to adult women), fitter women / more women working ;

4 more promiscuity ;

5 more, STD / breast cancer / cervical cancer ;

6 population decrease ; [2 max]

[Total: 8]

Q4.

3 **(a)** **E** – spermatogonium/germinal epithelial cell ;
F – secondary spermatocyte ;
G – spermatid ; **R** spermatozoa
H – Sertoli cell/nurse cell ; [4]

(b) *Accept identification of cells from diagram.*

1 cell **E** mitosis ;

2 (**E** / spermatogonia) increases in size/AW ;

3 becomes a primary spermatocyte ;

4 (primary spermatocyte) meiosis **I** ;

5 forms secondary spermatocyte(s) ;

6 2n to n/diploid to haploid/halving chromosome number ; [4 max]

[Total: 8]

Q5.

2 **(a)** 1 receptor or binding site not, complementary/specific, to FSH ;

2 FSH has shorter β chain than LH ; **ora**

3 FSH has different, primary structure/sequence of amino acids ;

4 FSH has different, tertiary structure/3D shape ; [3 max]

(b) **(i)** follicle (cells) ; **A** granulosa (cells) [1]

(ii) corpus luteal (cells) ; **A** granulosa (cells) [1]

(c) 1 (binding to a receptor), acts as a signal to the cells/stimulates cells ;

2 to, start/increase, synthesis of hormone ; **A** cells start to divide

3 oestrogen secreted ; **A** mature follicle formed (oestrogen),

4 stimulates thickening of endometrium/inhibits FSH (production) ; [3 max]

[Total: 8]

Q6.

3 **(a)** 1. ref. hormone treatment ;
2. results in, superovulation / many oocytes / many follicles, maturing at same time ;
3. oocytes harvested ;
4. detail of harvesting ;
5. mixed with sample of sperm ;
6. in special medium ;
7. idea of, waiting for three days / wait until 6–8 cell stage ;
8. embryos placed in uterus ;
9. ref. maintenance of endometrium ;
10. sperm / sperm nucleus / sperm DNA, may be injected into oocyte ; [4 max]

(b) *one mark for a ✓ in the correct box*
more than one ✓ in a row = no mark
ignore crosses

DNA – colourless ;
acrosome – colourless ;
mitochondria – green ; [3]

(c) 1. (hydrolytic) enzymes may damage oocyte ;
2. (acrosome contents) affect development of fertilised oocyte ; [1 max]

[Total: 8]

Q7.

3 (a) **A** – germinal epithelium ;
B – theca / wall of follicle ;
C – follicle cells / granulosa cells / corona radiata ;
D – oocyte ; **R** ovum / egg [4]

(b) 1. (progesterone / oestrogen), reduce the production of, FSH / LH ;
2. negative feedback ;
3. to, hypothalamus / anterior pituitary ;
4. idea of lack of FSH prevents maturation of follicle ;
5. lack of LH prevents ovulation ;
6. cervical mucus, thick / hostile to sperm ;
7. thin uterine lining prevents implantation ; [4 max]

(c) (i) 1. blocking gene means no, ZP3 / receptor (for sperm) ;
2. because no, transcription / translation / protein synthesis ;
3. sperm (head) has complementary shape to, ZP3 / receptor ;
4. fertilisation cannot occur ;
5. because sperm cannot bind (to oocyte) ; [3 max]

(ii) 1. idea of giving unwanted side effects ;
2. example ; *any one from*
nausea
mood swings
high blood pressure
risk of blood clots
headaches
weight gain
increased risk of breast cancer
3. to maintain natural hormone balance
or
because pill may reduce subsequent fertility ; [2 max]

(iii) 1. only oocytes affected / no other cells affected ;
2. ref. unknown / undesirable, effects elsewhere in the body ; [2]

[Total: 15]

Q8.

5 **(a)** 1. (mostly) secreted, during the second half of the cycle / from day 14 onwards ;

2. maintains, lining of the uterus / endometrium ;

3. in preparation for implantation ;

4. inhibits, GnRH / development of new follicle ; **A** FSH / LH [3 max]

(b) **(i)** 32.6 - 32.8 days ; [1]

(ii) 1. high fat diet causes decrease in age of puberty ;

2. change in either mother or her offspring has an effect ;

3. (from 40% +) greater effect by changing mother's diet;

4. use of comparative figures ;

5. cannot assume that effect on humans would be the same as on rats ;

6. no data provided on change in diet in European girls ;

7. does not take into account other possible changes ;

8. AVP ; e.g. for mp 7 [4 max]

[Total: 8]

Q9.

5 **(a)** contains oestrogen and progesterone ; **A** progesterone only

prevents, fertilisation / ovulation / implantation ;

negative feedback on / inhibition of, FSH / LH ;

AVP ; e.g. change in cervical mucus / thinning of uterine lining [2 max]

(b) (i) 24 813 ;;

allow one mark for working

e.g. 27 000 x (8.1 ÷ 100) = 2187 so, number born was 27 000 – 2187

or
27 000 x 91.9 % [2]

(ii) ARVs have no effect on, number of pregnancies / whether or not a woman gets pregnant ;
ARVs do not get rid of HIV (so cannot reduce number of pregnancies in HIV-infected women) ;

contraception reduces the number of pregnancies (in HIV infected women) ; [2 max]

(iii) 1. contraception reduces the number of (HIV-infected) pregnancies (but ARVs do not) ;

2. reference to advantage of this ; *e.g. fewer drugs needed if fewer HIV-infected pregnancies*

3. effect of (current and predicted use of) contraception greater than ARVs on births of HIV-infected children ;

4. comparative use of figures ;
ARV versus contraception for either pregnancies or births

5. ref. low cost of contraception compared with cost of ARVs ; **ora** [3 max]

[Total: 9]

Q10.

5 **(a)** (indicates that they) have undergone meiosis I;

so are, haploid/n ;
A 23 chromosomes [2]

(b) **(i)** water moved out of cells;

down water potential gradient/into a more concentrated solution/into a lower water potential;

(by) osmosis; [max 2]

(ii) (**B**) has, higher survival of oocytes after thawing/more successful fertilisations;

supporting figures;

*these should compare columns 1 or 2 with column 3 or 5 for both **A and B***
raw or manipulated data can be given [2]

(iii) idea of deferring, fertilisation/implantation;

idea of preserving oocytes from a woman who may lose her fertility due to medical treatment;

idea of fewer rounds of, hormone treatment/oocyte retrieval; [max 1]

[Total: 7]

Q11.

5 **(a)** correct ref. to woman being given hormones;

ref. to one suitable hormone, e.g. FSH / gonadotrophin / LH / GnRH agonist; [2]

(b) 1. capacitation;

2. able to undergo acrosome reaction;

3. able to swim (more vigorously); [max 2]

(c) **(i)** 1. fewer IVF cycles needed;

2. no need to transfer more than one embryo to the uterus;

3. so less chance of problems from multiple embryos;

4. less chance of miscarriage; [max 2]

(ii) 1. need to wait (at least 7.8 hours) before transferring embryo to uterus;

2. may be difficult to keep embryos in ideal conditions during this time period;

3. embryos destroyed; [2 max]

[Total: 8]

Q12.

6 **(a)** 1 ovulation stimulated by, FSH / hMG (human menopausal gonadotrophin) / GnRH / clomiphene ; ***R** hCG*
2 oocytes collected ;
3 use of fine tube / laparoscopy ;
4 oocytes placed (in dish) with, motile sperm / AW ;
5 inspected, after three days for embryos / when reaches 6-8 cell stage ;
6 (more than one) embryos selected and placed into uterus ;
7 ref. sperm DNA injected into oocyte ;
8 (hCG given to) maintain endometrium ;

***R** ova or eggs once* [4 max]

(b) **(i)** *(lower success rate in older women because)*
any two from

1. eggs may be less viable ;
2. more chromosome abnormalities in eggs ;
3. less eggs ;
4. hormones secreted less effective ;
5. hormones secreted in smaller quantities ; [2 max]

(ii) *any two from*

1. success rate is low ;
2. success falls off with age ;
3. takes money away from other services ;
4. reduces number of adoptions ;
5. social / ethical / religious, reasons ; [2 max]

[Total: 8]

Q13.

5 (a) *FSH:*

1 anterior pituitary gland ;

2 follicle ;

3 stimulates, growth of follicle / follicle to secrete oestrogen ;

progesterone:

4 corpus luteum ; **A** some from follicle cells **A** yellow body

5 endometrium (uterine epithelium) / anterior pituitary ; **A** lining **R** wall

6 stimulates glandular activity in endometrium **or** maintains / increases, thickness of endometrium **or** inhibits FSH secretion **or** inhibits LH secretion ; [6]

(b) 1 (effect on) hypothalamus / anterior pituitary ;

2 (both) inhibit secretion of, FSH / LH ;

3 (hence) no ovulation ; **R** ref. to eggs

4 ref. negative feedback ;

5 makes cervical mucus hostile to sperm / thickens mucus therefore stops sperm ;

6 prevents implantation ; [3 max]

[Total: 9]

Q14.

5	(a)		ductless gland ; secretes (hormone) into blood ;	[2]
	(b)	(i)	1. follicle, develops / matures / grows ; 2. detail follicle ; e.g. antrum / corona / theca 3. (follicle) secretes oestrogen (and progesterone) ;	[2 max]
		(ii)	trigger ovulation / description ;	[1]
	(c)	1 2 3 4	to produce many (mature) <u>oocytes</u> at same time ; <u>superovulation</u> ; make harvesting easier ; IVF procedure has low success rate ;	[2 max]
	(d)	(i)	a change sets off events that counteract the change / AW / example described ;	[1]
		(ii)	oestrogen inhibition of, GnRH / FSH ;	[1]
	(e)	(i)	day 9 ;	[1]
		(ii)	prevent ovulation / so <u>oocytes</u> can be harvested ;	[1]
	(f)	1 2 3 4	very little difference in percentage of pregnancies resulting in live birth ; standard (slightly) more oocytes (per cycle) ; ora standard (slightly) more embryos (per cycle) ; ora comparative figs ;	[3 max]
	(g)	1 2 3	(promoter needed) to ensure genes are, expressed / switched on ; to produce, correct product / correct hormone / FSH ; ref. human / eukaryote, gene in, bacteria / prokaryote ;	[2 max]
				[Total: 16]

Q15.

5	(a)		**A** – Leydig cell / interstitial cell ; **B** – (wall of) seminiferous tubule ;	[2]
	(b)	(i)	1 ;	[1]
		(ii)	*mark first two answers* E ; **A** secondary spermatocyte F ; **A** spermatid spermatozoan ;	[2 max]
		(iii)	cells grow in size / cells grow larger ;	[1]
	(c)	1	ATP production / provides energy ; **R** produces energy	
		2	(for) movement of flagellum ; **R** tail	
		3	(for) production of acrosomal enzymes ;	[2 max]

	(d)	(i)	1. infectious disease causes damage ; **A** mumps / Chlamydia / STDs 2. lower sperm count / absence of sperm ; 3. damaged / abnormal / immobile / lazy , sperm ; 4. blocked sperm ducts / lack of seminal fluid ; 5. named genetic condition ; e.g. CF 6. autoimmune reaction to sperm ; 7. reduced testosterone ; 8. effect of chemical damage ; e.g. chemotherapy / hormones in drinking water	[3 max]
		(ii)	(fertilisation of) <u>oocyte</u> by sperm ; in glass dish ; **A** appropriate glassware **R** test tube AVP ; e.g. sperm injected into oocyte	[2 max]
		(iii)	1. ovulation less likely ; 2. (older) <u>oocytes</u> less likely to be fertilised / <u>oocytes</u> less viable ; 3. implantation less likely (in uterus of older woman) ; 4. miscarriage rate increases (with age) ; 5. (as) lower concentration of hormones / unbalanced hormones (in older woman) / start of menopause ; 6. (as) genetic defects / mutations, increase (with age) ;	[3 max]
				[Total: 16]

Q16.

3 **(a)** 1 to give superovulation ;

2 follicles or oocytes, mature or develop, at the same time ; *ignore grow*

3 to prepare uterus for implantation ; [2 max]

(b) 1 germinal epithelial cell divides by mitosis ;

2 giving oogonia ;

3 primary oocyte divides by meiosis I (to give a secondary oocyte) ;

4 idea of diploid to haploid [3 max]

(c) *advantage*
ensure sperm enters oocyte / select (visibly) healthy sperm ;

disadvantage
unneeded parts of sperm enter producing unwanted effects
or
cannot tell whether a chosen sperm is genetically suitable ; [2]

[Total: 7]

Q17.

2 **(a)** 1 ref. differentiation / specialisation ;

2 ref. Sertoli cell ;

3 forms flagellum ; **A** tail

4 detail (of flagellum) ; e.g. microtubules

5 acrosome ;

6 detail (of acrosome) ; e.g. contains enzymes / modified lysosome

7 many mitochondria ; [4 max]

(b) *accept normal or healthy for undamaged*
accept abnormal or unhealthy for damaged

1 undamaged sperm move into lower chamber **or** damaged sperm stay in upper chamber ;

2 undamaged sperm have negatively charged (proteins) **or** damaged sperm lack negatively charged (protein) ;

3 undamaged sperm are, attracted to positive plate / repelled by negative plate ;
ora for damaged sperm

4 idea that undamaged sperm which have, moved / matured, slowly (in epididymis) ;
ora for damaged sperm [3 max]

[Total: 7]

Q18.

3 (a)

	male		female	
1	produces sperm	**or**	produces, oocyte	;
2	division of cytoplasm is equal	**or**	division of cytoplasm is unequal	;
3	four gametes produced	**or**	one gamete produced	;
4	no polar bodies	**or**	polar bodies	;
5	ref. maturation	**or**	no equivalent maturation stage	;
6	ref. meiosis completed	**or**	ref. incomplete meiosis	;

[3 max]

(b) 1. a ductless gland ;
2. hormones in the blood ;
3. ref. target, organ / tissues ; [2 max]

(c) 1. (both), reduce / stop, secretion (of FSH and LH) ;
2. (both) involve negative feedback ;
3. to, anterior pituitary / hypothalamus ;
4. both are, contraceptives / description ; [3 max]

[Total: 8]

Q19.

3 (a) (i) mitosis / multiplication / increase in number of cells ; **R** meiosis / growth / maturity / replicating [1]

(ii) meiosis I / reduction division / description ; [1]

(iii) maturation / differentiation / description ; [1]

(b)

statement	letter
contains protective fluid	**J** ;
produces oestrogen	**H** ;
has glycoprotein receptors	**G or H** ;
contains 23 chromosomes	**G or K** ;

[4]

(c) 1. hormone treatment ; **R** LH / HCG
2. to stimulate follicle development ;
3. superovulation / several follicles develop at same time ;
4. oocytes harvested ; *penalise eggs once*
5. detail of harvesting ;
6. semen / sperm, collected from man ;
7. *idea of* sperm activated ;
8. sperm added to oocyte(s) in dish ;
9. (potential embryos) inspected, two – three days later / 6–8 cell stage ;
10. embryo(s) inserted into uterus (through cervix) ;
11. AVP ; any two from e.g. donor oocytes / donor sperm / hormones to prepare uterine lining / ICSI *ignore ref. to oestrogen* [5 max]

(d) 1. percentage of live births decreases / miscarriage rate increases, with age ;
2. (as) fewer hormones / unbalanced hormones (in older woman) ;
3. (as) genetic defects / mutations, increase in oocyte (with age) ;
4. placental function less efficient ; [2 max]

[Total: 14]

Q20.

4 (a) (i) **A** ; [1]

(ii) **W** - spermatogonium ;
X - primary spermatocyte ;
Y - secondary spermatocyte ; [3]

(b) 3 marks for correct labels ;;; [3]

(c) (i) fertility / number of offspring, decreases ;

at 20°C the number of offspring is 280 while at 25°C the number of offspring is 150 / accept difference between figures ; [2]

(ii) smaller reduction in, fertility / number of offspring, in *alg–3* mutants than in *alg–4* mutants ; **ora**

manipulated data quote
either by 24% in *alg–3* **and** 61% in *alg–4*
or by 30 in *alg–3* **and** 135 in *alg–4* ; [2]

(iii) **D** ; [1]

(iv) *at 20°C*
difference due (only) to lack of (development of) motility (in mutants) / AW ; **R** ref to numbers of sperm

at 25°C
difference due to fewer sperm(atids) **and** less (development of) motility ; [2]

[Total: 14]

Q21.

5 (a) 1 ref. to suitable container e.g. dish
or
ref. suitable medium ;
2 ref. to addition of, sperm / semen, to oocytes ; [2]
A ICSI

(b) *advantage*
better chance of survival / more certain of getting a good-quality embryo / better chance of implantation ;
disadvantage
may be difficult to keep embryos alive for this time / embryos may become less viable / less chance of implantation ; [2]
only allow one mark for ref. to implantation

(c) (i) 1 higher % of pregnancies than the other methods ;
2 2. 35.1 % versus 22 .1% **or** 35.1% versus 34.6 % ;
3 little difference in the success rate of single top quality embryo transfer compared to multiple embryo transfer ;
4 multiple embryos increases risk of problems during pregnancy / birth ; [3 max]

(ii) 1 could lead to selection of features desired by parents / society
or less chance of a child being born with features seen as undesirable ;
2 ref. to discarding other embryos ; [1 max]

[Total: 8]

Q22.

4 (a) (i) working ; e.g. 1st oestrogen peak at day 13, 2nd peak at day 41 / looked at two peaks and calculated number of days in between

28 ; [2]

(ii) began: day 13 or14 ;

ended: day 29 or 30 ; [2]

(iii) (anterior) pituitary (gland) ; **R** posterior pituitary [1]

(iv) 1. stimulates follicle ;

2. to secrete oestrogen ;

3. surge in LH secretion;

4. stimulates ovulation ;

5. ref. development of corpus luteum / stimulates corpus luteum ;

6. to secrete progesterone ; [max 3]

(b) (i) 1. ref. reliability ;

2. ref. to irregularity of cycles ;

3. *idea that* cannot be sure about menstrual phase on day 22 ;

4. *idea that* using hormones alone might not identify day of cycle precisely enough ; [max 2]

(ii) 1. (yes because) oestrogen concentration high on day 22 and low on day 2 ;

2. (but) shows correlation but not necessarily, linked / causal effect ;

3. concentration of progesterone could be affecting performance ;

4. (progesterone concentration) high at 22 days and low on day 2 ;

5. not LH as concentration low on both days ;

6. ref. to small numbers in investigation / more evidence needed ;

7. ref. to use of statistics to determine if difference in results is significant ; [max 4]

[Total: 14]

Q23.

4 **(a)** idea that sperm can survive for several days ;

so fertilisation can occur, at / after, ovulation ; [2]

(b) **(i)** low until around day 13 then one peak returning to low at around day 28 ;

peak around day 22 ; [2]

(ii) began: day 1 *and* ended: day 14 ; [1]

(c) **(i)** 1. ref. to irregularity of cycle ;

2. example of factor affecting cycle ; e.g. illness / travel / stress / synchronicity [2]

(ii) 1. avoid sexual intercourse when LH level high ;

2. can predict next LH surge ; [2]

(iii) 1. change in basal temperature (at ovulation) is only small ;

2. *idea of* continuous monitoring / avoids, misreading values / inaccuracy / missing temperature change ; ora for thermometer [2]

(d) 1. there is a possibility of becoming pregnant on most days of the cycle ;

2. guidelines should include more days before and after ovulation ;

3. not possible to become pregnant on days 1–3 and days 27–29 ;

4. *idea of* days 10 to 17 are centred around the highest probability ;

5. ref. to day 18 having same probability as day 10 ;

6. comparative figures ; e.g. probability on two different days

7. idea of women with irregular cycles have more variation (in fertile window) ; [max 4]

[Total:15]

Q24.

4 **(a)** **(i)** spermatagonium – 2n
primary spermatocyte – 2n
secondary spermatocyte – n
spermatids – n
spermatozoan – n ;;

all five correct for two marks
three or four correct for one mark [2]

(ii) (spermatogonium to primary spermatocyte) growth / mitosis ;

(spermatid to sperm) maturation ; [2]

(iii) *any 1 from*

provide nutrients for sperm(atid) ;

protect sperm from attack from immune system ;

regulation of, sperm production / FSH ;

AVP ; e.g. removes excess cytoplasm during sperm maturation /
guides sperm to centre of tubule [max 1]

(b) FSH ;

(hormone) given to stimulate follicle development ;

GnRH agonists / GnRH receptor antagonists ;

to prevent, LH surge / ovulation ;

human chorionic gonadotrophin ;

(hormone) given to stimulate maturation of oocytes ;

(mature oocytes) collected from ovaries (just before ovulation) ;

ref. use of, fine tube/ needle/ ultrasound ; [max 4]

(c) **(i)** FSH (alone)/FSH + testosterone, increases development (of spermatids into, spermatozoa / elongated cells) ;

testosterone (alone) has very little effect ;

FSH + testosterone causes greatest increase of development ;

use of, comparative/ manipulated, figures ; [4]

(ii) (reduction is very small so) may be, insignificant / random / due to chance ;

(some cells) may have died ; [max 1]

(iii) temperature, similar to testes / in range 30 °C to 35 °C / lower than core ;

spermatozoa production, will not proceed at 37 °C / at high temperature ; [2]

[Total: 16]

Q25.

5 **(a)** anterior pituitary ; [1]

(b) **(i)** early follicle development not dependent on FSH ;

with no FSH / no FSH receptors, follicle development stops ; **ora**

with no FSH / no FSH receptors, Graafian / ovarian, follicle does not develop ; **ora**

with no FSH / no FSH receptors, there is no ovulation ;

no corpora lutea because these form, from Graafian follicle / after ovulation ; [max 4]

(ii) sperm development better when FSH present ;

with FSH receptors
more sperm produced ; **ora**

sperm more active ; **ora**

males have increased fertility ; **ora**

without FSH receptors
some sperm produced ; [max 3]

[Total:8]

Section_B

1.

11 **(a)** 1. rise in blood glucose concentration detected by β cells ;

2. (β cells) in, islets of Langerhans / pancreas ;

3. insulin released into blood ;

4. binds to receptors in cell surface membrane ;

5. ref. to liver / muscle, cells ;

6. increase in uptake of glucose (by cells) /
(cell surface) membrane more permeable to glucose ;

7. increase in use of glucose in respiration ;

8. (increase in) conversion of glucose to glycogen ;

9. blood glucose concentration falls ;

10. inhibits, glycogen / lipid / amino acid, breakdown ; [max 6]

(b) 1. (stick / kit) dipped in (early morning) urine sample ;

2. hCG / urine, moves up strip ;

3. idea that hCG acts as antigen ;

4. (mobile) antibody also bound to, indicator / gold ;

5. (mobile) antibody in stick binds to hCG ;

6. ref. to variable region (of antibody) ;

7. ref. to specificity (of antibody) ;

8. ref. to monoclonal (antibody) ;

first window or region
9. second antibody is, immobilised / fixed ;

10. first antibody and hCG complex binds to second antibody ;

11. coloured band indicates pregnancy ;

second window or region
12. immobile antibody binds to mobile antibody-gold complex ;

13. second coloured band shows strip is working ; [max 9]

[Total: 15]

2.

10 (a) 1 FSH/LH, released by anterior pituitary ;

2 Graafian/ovarian, follicle develops/AW ;

3 oestrogen produced by follicle (cells) ;

4 oestrogen conc rises for first 12 days ;

5 causes, endometrium to thicken ; **A** detail such as increase in blood vessels

6 (around day 14) surge in LH/AW ;

7 stimulates ovulation/AW ;

8 corpus luteum develops ;

9 produces progesterone ;

10 causes, further development of endometrium ;

11 if no fertilisation, secretion of FSH/LH inhibited ;

12 corpus luteum, degenerates/AW ;

13 progesterone conc falls ;

14 endometrium breaks down/menstruation occurs ;

15 negative feedback in correct context ; [max 9]

(b) 1 (homeostasis is) maintenance of, constant/stable, internal environment ;

2 irrespective of changes in external environment ;

3 negative feedback ;

4 *ref. to* input/stimulus ;

5 receptor detects change in parameter ;

6 action taken by effector/response/AW ;

7 restoration of, norm/set point/AW ;

8 *ref. to* fluctuation around the norm ;

9 example of homeostasis ; [max 6]

[Total: 15]

3.

10 (a) 1 *ref. to* hormone treatment ;

2 results in, superovulation
or
many oocytes / many follicles, maturing at same time ;

3 oocytes harvested ;

4 detail of harvesting ;

5 mixed with sample of, sperm / male gametes ;

6 in special growth medium ;

7 wait, for three days / until 4–8 cell stage ;

8 embryos placed in uterus ;

9 *ref. to* maintenance of endometrium ; e.g. progesterone treatment

10 if sperm count very low ICSI used ;

11 sperm / sperm nucleus / sperm DNA, may be injected into oocyte ; [max 8]

(b) 1 'not natural' / technological process ;

2 *ref. to* multiple births ;

3 (possible) birth defects ;

4 cost to health service / only wealthy can access IVF ;

5 some embryos discarded ;

6 unknown effects of freezing embryos for storage ;

7 issues regarding use of stem cells ;

8 issues regarding selection of gender etc. ;

9 issues regarding, single people / gay people, having children by this method ;

10 extending age of conception of women past menopause ;

11 issues regarding, egg donation / surrogate mothers ;

12 *ref. to* psychological effects ; [max 7]

[Total: 15]