1. (i) **C** 1

(ii) FSH stimulates development of follicles / ovaries which release oestrogen;
(build up of) oestrogen inhibits FSH; 2

[3]

2. (a) **EITHER**

answer clearly derived from $\frac{\text{large}\,\text{small}}{\text{small}} \times 100\%$ (gains 2 marks) ; ;

(if only correct subtraction (large - small) = 1 mark)

OR

$\frac{\text{large}}{\text{small}} \times 100 = z$;

z-100 = answer;

(Ignore absolute values of figures) 2

(b) Answers to (i) and (ii) clearly linked
(Mark as a whole)

(i)
1. More mitochondria;
2. more Golgi;
3. more E.R.;
4. more (hetero)chromatin;
5. more vesicles / vacuoles;
6. more ribosomes;

(ii)
1. Produces ATP *I* energy;
2. Golgi site of lipid *I* steroid / testosterone synthesis! vesicle production;
3. E.R. for transport (of testosterone);
4. <u>enzyme</u> production / receptor production;
5. packaging / transport (of testosterone);
6. enzyme production; max 4

(c) 0 - 2 days / before castration when testosterone / chemical present - LH ± constant / small oscillation / kept low;
after 2 days / post castration no testosterone / chemical present - LH rises;
Need only **one** reference chemical
(wrong hormone = max 1) 2

(d) LH fits / binds into (specific) receptor on cell surface membrane;
releases / activates enzyme / adenylate cyclase / kinase;
(which produces) cAMP from ATP;
1st cAMP activates enzyme;)
) Linked
2nd in pathway involved in synthesis of testosterone;)
(Ignore cascade effect) max 3

[11]

3. (a) (i) Luteinising hormone/LH; 1

(ii) Increases; (**I** ref to hormone)
falls before menstruation/at end of cycle/day 26-28/ when corpus luteum degenerates; 2

(b) Inhibits FSH; (**I** ref to LH)
which stimulates development of a follicle/no follicle will develop;
failure to ovulate/release egg/release ovum; max. 2
R effects on uterus eg thickening of mucus

[5]

4. (a) Stimulates FSH secretion;
leading to production of mature oocyte / egg cell / growth of follicle;
I refs to ovulation. 2

(b) (i) Similar shape;
attaches to receptor site;
but not active;
stop GnRH molecules fitting / blocks site;
therefore FSH secretion not stimulated; max 3

(ii) Peptide hormones only affect pituitary; steroids affect breast / uterus;
link with possession of receptors; max 2

(c) Peptides would be digested / broken down by enzymes in gut; 1

(d) (i) Enables base sequence of DNA/gene to be determined; 1

(ii) Human DNA cut with restriction enzyme;
vector identified as a plasmid/virus;
vector (DNA) cut with restriction enzymes;
appropriate reference to sticky ends;
pieces of DNA joined with ligase; max 3
(if both 1st and 3rd points made, then for 2 marks must make clear it is the **same** enzyme)

(e) B cells/B lymphocytes linked to antibody production;
selection/activation of specific B cells;
cloning/mitosis/multiplication of these cells;
plasma cells formed; max 3

(f) hCG destroyed/not effective;
corpus luteum breaks down;
so progesterone not produced;
progesterone needed for maintenance of uterine lining/endometrium; max 3

(g) This will only prevent action of hCG;
even during pregnancy TSH will be important/eq 2

[20]

5. (a) Around day 2 / day 20;
Coincides with LH / FSH peak; 2

(b) (No) / (no mark for no)
Progesterone levels fail; 1

[3]

6. (a) FSH stimulates growth of a follicle;
Developing follicle produces oestrogen;
(FSH) and LH bring about ovulation / oestrus;
LH stimulates formation of corpus luteum;
LH stimulates production of progesterone;
Fall in LH / FSH means oestrogen production no longer stimulated; 5 max

(b) (i) Progesterone inhibits FSH;
No follicles develop;

(ii) Causes rise in FSH / inhibition of FSH removed;
Stimulates follicle development; 4

[9]

7. (a) (i) LH peaks/is high (on day 12): 1

(ii) Sperm can survive up to 2-7 days;
Eggs can survive few hours/ up to 3 days;
OR General idea of short-lived gametes (e.g. a few days) = max. 1 mark 2

(b) (i) 1nhibits (release of) FSH;
Follicle does not develop/mature/grow/prevent ovulation/
FSH causes follicles to develop; (*Allow: 'ovum not produced*)
[Reject: reference to "follicle production"] 2

(ii) Progesterone; 1

[6]

8. Quality of Language

The answer to this question requires continuous prose. Quality of language should be considered in crediting points in the mark scheme. In order to gain credit, answers must be expressed logically in clear scientific terms.

(a) Any **two** from:
Follicle diameter/size drops suddenly on day 21/at this time;
Egg/ovum/oocyte released from follicle (causes size decrease);
Corpus luteum formed on day 21/at this time; max 2
[*Note: Maximum 1 mark if no time given*]

(b) On day 18 oestrogen peaks/at 6.0/rises to highest value;
= 1 day before start of oestrus; 2

(c) Size and concentration show a positive correlation/described;
Corpus luteum produces progesterone; 2

(d) Any **six** from:
1 Progesterone inhibits (release of) FSH/LH;
2 Once progesterone falls (on day 16) FSH increases;
3 FSH increase causes follicles to develop;
4 Developing follicles produce oestrogen;
5 Oestrogen inhibits FSH (release);
6 High oestrogen/approx. day 18 stimulates FSH (release);
7 High oestrogen stimulates LH (release);
8 LH causes ovulation/causes progesterone (release)/formation of corpus luteum; max 6

(e) (i) Knows when to perform A.I./to introduce male/to impregnate /to increase chance of fertilisation / to ensure synchronised birthing; 1

(ii) Any **two** from:

Hormones may be present in animal's muscles / in meat / may be ingested by humans;
Hormones may be toxic / have undesirable / unknown effect in humans/may affect human female menstrual cycle/alter fertility;
(Don't need to because) able to predict oestrus in pig via behaviour/via urine analysis; max 2

[15]

9. (a) (i) A D C E B ; 1

(ii) B / corpus luteum; 1

(iii) stimulates growth of/maintains uterus lining/endometrium /
stimulates growth of blood vessels in uterus lining /
stimulates development of glands in uterus lining /
stimulates secretion of fluid in uterine lining /
stimulates invagination of uterine lining;
(*Reject ref. repair/wall of uterus, Ignore contractions*) 1

(b) (i) day 12 / day 40; 1

(ii) LH falls after peak / FSH and/or LH rise again in another cycle; 1

[5]

10. (a) Causes growth of follicle/oocyte;
Causes secretion of oestrogen;
With LH, stimulates ovulation; max 2

(b) (i) curve shown rising to day 21;
curve shown falling day 21 – 24; 2

(ii) (Concentration of) FSH remains low / returns to starting level; 1

(c) (i) Progesterone would inhibit FSH;
So no follicles/oocytes develop; 2

(ii) LH is released / no longer inhibited;
Triggers ovulation / release of ovum/egg; 2

[9]

11. General Principles for marking the Essay:

Four skill areas will be marked: scientific content, breadth of knowledge, relevance and quality of language. The following descriptors will form a basis for marking.

Scientific Content (maximum 16 marks)

Category	Mark	Descriptor
	16	
Good	14	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	12	
	10	
Average	8	A significant amount of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A-level study. Generally accurate with few, if any fundamental errors. Shows a sound understanding of most of the principles involved.
	6	
	4	
Poor	2	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A-level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	0	

Breadth of Knowledge (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all areas that might realistically be covered on an A-level course of study.
2	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
1	Unbalanced account with all or almost all material based on a single aspect
0	Material entirely irrelevant.

Relevance (maximum 3 marks)

Mark	Descriptor
3	All material presented is clearly relevant to the title. Allowance should be made for judicious use of introductory material
2	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
1	Some attempt made to relate material to the title but considerable amounts largely irrelevant.
0	Material entirely irrelevant or too limited in quantity to judge.

Quality of language (maximum 3 marks)

Mark	Descriptor
3	Material is logically presented in clear, scientific English. Technical terminology has been used effectively and accurately throughout.
2	Account is logical and generally presented in clear, scientific English. Technical terminology has been used effectively and is usually accurate.
1	The essay is generally poorly constructed and often fails to use an appropriate scientific style and terminology to express ideas.
0	Material entirely irrelevant or too limited in quantity to judge.

[25]

Additional notes

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be drawn from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

12. (a) progesterone/oestrogen;
luteinising hormone/LH;
oestrogen; 3

(b) little or no oestrogen;
produced by follicle;
oestrogen inhibits FSH; 3

[6]

13. (a) (i) **R**, **P**, **Q**; 1

(ii) luteinising hormone/LH; 1

(b) stimulates growth of/maintains uterine lining; stimulates growth of blood vessels in uterine lining; stimulates invagination of uterine lining; stimulates production of mucus; inhibits contraction of uterus; 2 max

(c) inhibits follicle stimulating hormone/FSH;
prevents follicle developing / releasing an ovum; 2
Reject stops ova being produced or release of follicle.

(d) removes inhibition of FSH / FSH production starts;
stimulating follicle development;

OR

removes inhibition of LH / LH production starts;
stimulating ovulation; 2

[8]

14. (a) Day 20 - 22;
follicle is largest prior to ovulation; 2

(b) Another follicle develops;
corpus luteum degenerates; 2

(c) (i) oestrogen; 1

(ii) High hormone X (oestrogen) prevents follicles developing as no FSH released; 1

[6]

15. (a) (i) pituitary; 1

(ii) oestrogen; 1

(b) (i) 'O' marked on or immediately after the peak of LH curve; 1

(ii) negative feedback / inhibition; 1

(iii) breakdown/ageing of the Graafian/ovarian follicle (which secretes oestrogen); 1

[5]

16. (a) FSH secreted by pituitary gland;
Stimulates growth of follicle;
Ovary/follicle cells produce oestrogen;
Negative feedback/inhibits secretion of FSH;
Oestrogen stimulates secretion of LH/LH from pituitary;
LH stimulating ovulation;
Second increase in FSH also associated with ovulation; max 6

(b) Stimulus is increased blood temperature;
Increase in temperature results from exercise/respiration/metabolism;
Detected by receptors in hypothalamus;
Hypothalamus is coordinator;
In this case, the heat loss centre;
Effectors are muscles;
Of arteriole;
Response involves vasodilation;
Increased blood flow to capillaries;
Allowing heat loss by radiation/convection;
Correct reference to action potential/nerve impulse; max 6

[12]

17. (a) Production of FSH/LH/pituitary hormones;
Stimulate ovary/follicle development;
Producing oestrogen;
Oestrogen stimulating breast development;
Oestrogen stimulating pelvic girdle growth;
Androgen secretion;
Androgens responsible for growth spurt/pubic hair development;
Growth hormone also involved; max 6

(b) (i) Negative feedback;
Inhibits FSH secretion;
Follicles do not develop
No ovulation; max 3

(ii) Oestrogen secreted by follicles;
Therefore no oestrogen/low concentration of oestrogen;
Oestrogen secretion will not be cyclical;
Not available to inhibit pituitary gland;
Therefore high concentration of FSH; max 3

[12]

18. (a) Pituitary gland; Ovary; Triggers ovulation/formation of corpus luteum;
Stimulates growth of/maintains uterine lining/inhibits FSH/LH/GnRH/gonadotrophins; 4

(b) (i) FSH required for development of mature follicle/egg cell; 1

(ii) Prevents oestrogen affecting hypothalamus:
No negative feedback;
Production of FSH no longer inhibited; max 2

[7]

19. (a) Less random, so more chance of pollination;
less pollen has to be produced / less 'food' needed;
insects move to another of same species/type of flower;
insects deliver lots of pollen to a single flower. 2 max

(b) Anthers hang outside and thus exposed to wind;
feathery shape of stigmas gives large surface area to catch pollen;
anthers emerge before stigmas, preventing self-pollination 2 max

(c) (i) Pollen count rises when temperature rises/higher the temperature,
the higher the pollen count; 2

(ii) Variation in pollen count (over short period of time) 1

(d) Explanation linked to changing temperature / conditions shown by data;(i.e. a suitable factor)
Explanation related to effect on walls, e.g. drying out and cracking open.
(*Accept other well argued case, e.g. based on increasing cell concentration and osmosis*) 2

(e) Economical use of pollen (since pollination is likely);
less energy needed for producing pollen;
flowers all mature at same time,
so more likely that female organs will receive pollen) 1

[10]

20. (a) (high concentration of) oestrogen inhibits FSH production;
follicles / oocytes do not develop (in ovary);
no ovulation / no egg to fertilise; 3

(b) Pheromone(s) (in sweat);
hormone from hypothalamus stimulates/passes to pituitary;
increased FSH production by pituitary;
(FSH) stimulates oestrogen production by ovary; 3 max

[6]

21. (a) ovulation;
development/maintenance of corpus luteum;
stimulates release of progesterone; 1 max

(b) (i) amino and carboxyl groups;
sulphur/sulphide bonds;
across/spans whole membrane; 2 max

(ii) specific shape;
which is complementary to hormone shape; 2
(*max one mark if reference to active site*)

(c) (i) testosterone released / produced;
important for maintenance of secondary sexual characteristics /
sex drive/named characteristic; 2

(ii) digested;
by proteases/named protease (in stomach/intestine); 2

[9]

22. (a) (i) stimulates <u>growth/development/maturation</u> of the follicle;
stimulates hormone production; 2
(*reject reference to ovulation)*

(ii) specific/irregular/tertiary shape;
receptor <u>complementary</u> (shape);
binding; 3

(b) (i) P - progesterone;
Q - oestrogen; 2

(ii) no inhibition/negative feedback;
of (FSH release by) pituitary/hypothalamus;
by oestrogen/lower oestrogen; 2 max

[9]