Human Reproduction

Standard difficulty · 20 questions · 40 marks · Time: 42 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The testes lie outside the body in the scrotum because sperm formation needs a temperature:
(a) equal to body temperature **(b)** below 0 °C
(c) above body temperature **(d)** about 2–2.5 °C below body temperature

2. The number of chromosomes in a spermatid of a human is:
(a) 23 **(b)** 46 **(c)** 92 **(d)** 69

3. 490 primary oocytes complete oogenesis (after fertilisation). The number of ova formed is:
(a) 1,960 **(b)** 980 **(c)** 490 **(d)** 1,470

4. The main role of the placenta is:
(a) movement of the ovum and early embryo towards the uterus
(b) release of enzymes that help the sperm enter the ovum
(c) secretion of androgens such as testosterone
(d) exchange of food, oxygen and wastes between mother and foetus

5. Which of these is secreted by the ovary late in pregnancy?
(a) relaxin **(b)** progesterone **(c)** oxytocin **(d)** prolactin

6. In human pregnancy, the baby is ready to be born:
(a) by the end of the first trimester (12 weeks)
(b) by the end of about 24 weeks (second trimester)
(c) at about nine months
(d) after one month of pregnancy

7. In a woman with a regular menstrual cycle of 28 days, ovulation is most likely on about:
(a) day 7 **(b)** day 21 **(c)** day 14 **(d)** day 28

8. Assertion (A): 10 primary oocytes form 10 ova.
Reason (R): Each primary oocyte divides equally to form four ova.
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. What is the role of the acrosome?

10. A healthy ejaculate has about 246 million sperms. For normal fertility at least 60% should have a normal shape and at least 40% should swim vigorously. Find the minimum numbers of each.

11. How many sperms are formed from 300 primary spermatocytes, and how many ova and polar bodies from 300 primary oocytes (if the first polar body also divides)?

12. The zygote divides by cleavage 5 times. How many cells (blastomeres) are there? How many divisions give 8 cells? At about what stage is the embryo called a morula?

13. A woman's cycle is 30 days long and menstruation lasts 5 days. On about which day does she ovulate? Which phases come before and after ovulation, and which hormone dominates each?

14. What do oestrogen and prolactin do in human reproduction?

15. How many chromosomes are there in a Leydig cell and in a primary spermatocyte? Say whether each is haploid or diploid.

16. (a) At what stage of pregnancy does this happen: the first movements of the foetus are felt and hair appears on the head? (b) What is the main role of the endometrium?

Section C — Word problems — 4 × 4 = 16 marks

17. Describe spermatogenesis and its hormonal control.

18. Compare spermatogenesis and oogenesis starting from 200 primary spermatocytes and 200 primary oocytes: give the number of functional gametes, the number of polar bodies, the chromosome number at each stage, and where and when each process takes place.

19. Describe the menstrual cycle of a woman with a 31-day cycle: the phases with their approximate days, the hormones involved, and what happens if the ovum is not fertilised.

20. Trace the events from fertilisation to implantation in humans. How many cells does the embryo have after 5 cleavage divisions, how many divisions give 128 cells, and what are the layers of the blastocyst?

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Answer key

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Q	Answer	Working
1	**(d) about 2–2.5 °C below body temperature**	—
2	**(a) 23**	haploid, after meiosis I
3	**(c) 490**	each primary oocyte gives one ovum and polar bodies
4	**(d) exchange of food, oxygen and wastes between mother and foetus**	—
5	**(a) relaxin**	—
6	**(c) at about nine months**	—
7	**(c) day 14**	the luteal phase lasts about 14 days, so ovulation is about 14 days before the next period
8	**(c) A is true, but R is false.**	A is true: each primary oocyte gives one ovum; the other products are polar bodies. R is false.
9	**It is a cap on the sperm head containing enzymes that help the sperm penetrate the layers around the ovum.**	—
10	**147.6 million normal; 98.4 million vigorously motile**	60% and 40% of 246 million
11	**1,200 sperms; 300 ova and 900 polar bodies**	spermatogenesis: 4 per cell; oogenesis: 1 ovum + 3 polar bodies
12	**32 cells; 3 divisions; a morula has 8 to 16 cells**	each division doubles the number: $2^5 = 32$ and $2^3 = 8$
13	**day 16; follicular (proliferative) phase from day 6 to day 15, mainly oestrogen; luteal (secretory) phase from day 17 to day 30, mainly progesterone**	the luteal phase lasts about 14 days
14	**Oestrogen: builds up the endometrium in the follicular phase; prolactin: stimulates milk production**	—
15	**a Leydig cell: 46, diploid; a primary spermatocyte: 46, diploid**	meiosis I halves the number
16	**(a) during the fifth month; (b) implantation of the blastocyst**	—
17	**In the seminiferous tubules, spermatogonia (2n) divide by mitosis; some grow into primary spermatocytes (2n), which complete meiosis I to form secondary spermatocytes (n) and then meiosis II**	—

Q	Answer	Working
	to form spermatids (n), which change into sperms (spermiogenesis). GnRH from the hypothalamus causes LH and FSH release: LH makes Leydig cells secrete androgens, which drive spermatogenesis; FSH acts on Sertoli cells, which help spermiogenesis.	
18	Spermatogenesis: 800 sperms; no polar bodies; spermatogonium and primary spermatocyte 46, secondary spermatocyte, spermatid and sperm 23; in the seminiferous tubules, continuously from puberty. Oogenesis: 200 ova; up to 600 polar bodies; oogonium and primary oocyte 46, secondary oocyte and ovum 23; in the ovary, begun before birth, completed only after fertilisation	—
19	Menstrual phase (days 1–4 or 5): the endometrium breaks down. Follicular phase (to about day 16): FSH grows follicles, which secrete oestrogen that rebuilds the endometrium. Ovulation about day 17: triggered by the LH surge. Luteal phase (days 18–31): the corpus luteum secretes progesterone to keep the endometrium ready. Without fertilisation the corpus luteum degenerates, progesterone falls and menstruation starts again	—
20	Fertilisation in the ampulla forms the zygote (46). It divides by cleavage as it moves down the oviduct: after 5 divisions it has 32 cells, and 128 cells need 7 divisions; at 8–16 cells it is a morula, which becomes a blastocyst with an outer trophoblast and an inner cell mass. The trophoblast attaches to the endometrium and the blastocyst becomes embedded (implantation); the inner cell mass becomes the embryo	—

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