

SAMPLE TEXTBOOK ANSWERS

Chapter 16 Reproductive cycles and fertilisation

The following are sample answers only. Other answers to the same questions may also be correct.

Science inquiry

Activity 16.1 The ovary

Studying your observations

- 1 Draw a diagram of your observations, labelling all visible structures.

Answer: Students should draw a simplified diagram similar to that shown in Figure 16.1 on page 210.

- 2 Compare your drawing with Figure 16.1. Were there any structures you were unable to see on the microscope slide? If so, you may wish to annotate your diagram using information from Figure 16.1.

Answer: Students should refer to Figure 16.1 on page 210 and annotate their diagrams accordingly.

Review questions

- 1 a List the stages of the ovarian cycle, using a diagram to illustrate your answer.

Answer:

- Cells forming the wall of the primary follicle begin to enlarge and divide.
- Secretions of these cells create a fluid-filled space.
- The egg is forced to the edge of the follicle to form the secondary follicle.
- The secondary follicle enlarges and moves towards the edge of the ovary to become a mature follicle.
- The mature follicle bursts to release the egg (ovulation).
- The ruptured follicle collapses and forms the corpus luteum.
- If fertilisation does not occur, the corpus luteum degenerates into a fibrous mass known as the corpus albicans.

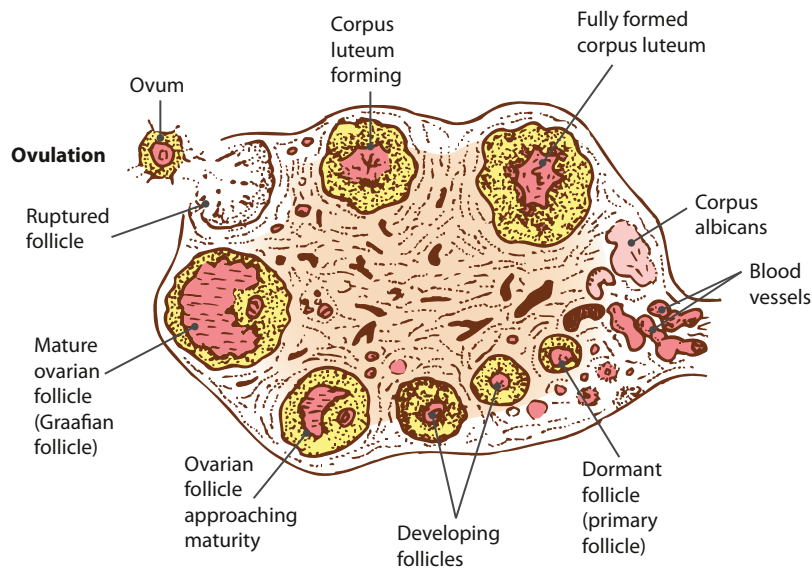


Figure 16.1 The sequence of events in the ovarian cycle, including ovulation

b What is ovulation?

Answer: Ovulation occurs when a mature follicle (Graafian follicle) on the surface of the ovary bursts and releases an ovum.

c Describe the changes undergone by the corpus luteum during a normal ovarian cycle. How do these changes differ if pregnancy occurs?

Answer: Once the mature follicle (Graafian follicle) has released the ovum it collapses forming a corpus luteum (containing a blood clot). The corpus luteum secretes the hormone progesterone to increase the endometrial lining ready for implantation if fertilisation does occur. If fertilisation does not occur then the corpus luteum breaks down into scar tissue 8–10 days after ovulation. This fibrous scar tissue is called the corpus albicans and it eventually disappears.

If pregnancy occurs, the corpus luteum continues to develop and secrete the hormone progesterone to maintain the endometrium, aid the development of and maintain the placenta, and to help develop the milk-secreting glands in the breasts. The ovarian cycle stops with pregnancy. The corpus luteum begins to slowly degenerate in the third month of pregnancy, but is still present in the ovary at childbirth.

2 Outline the major events of the menstrual cycle, and relate these to the stages of the ovarian cycle.

Answer: The menstrual cycle is closely linked to the ovarian cycle. As a follicle in the ovary is maturing, the endometrium of the uterus becomes thicker and softer, with an increased number of blood vessels and mucus-secreting glands. The endometrium continues to thicken after ovulation. The development of the endometrium is in preparation for an embryo, should fertilisation occur. If fertilisation does not occur, the corpus luteum degenerates, reducing the amount of hormone influencing the build-up of the endometrium, resulting in its breakdown. Menstruation occurs approximately 14 days after ovulation, when blood from the broken-down capillaries, mucous secretions and cell debris from the uterine lining are discharged through the vagina.

This could also be summarised as a table:

Ovarian cycle	Menstrual cycle
• Ovarian follicle develops	• Pre-ovulation – endometrium thickens and softens
• Ovulation – egg released from follicle	• Ovulation – endometrium continues to thicken and soften
• Corpus luteum develops from vacated follicle	• Secretion of mucus – breakdown of unfertilised ovum
• Corpus luteum breaks down	• Endometrium begins to break down
• Corpus albicans forms from corpus luteum	• Menstruation – loss of the lining of the uterus

See also Figures 16.3a and 16.3b on page 212.

3 a Explain what ‘target organ’ means.

Answer: A target organ for a hormone is the organ that is affected by that particular hormone.

b What are the target organs for testosterone and follicle-stimulating hormone?

Answer: Testosterone targets many organs, such as the seminiferous tubules in the testes, particularly the male reproductive organs during puberty.

Follicle-stimulating hormone (FSH) targets the follicle of the ovary in females and the seminiferous tubules of the testes in males.

4 Explain the role of hormones in regulating the ovarian and menstrual cycles.

Answer: Follicle-stimulating hormone (FSH) causes the follicle in the ovary to develop and mature. Simultaneously, oestrogens are secreted from the ovarian follicle. As the level of oestrogen increases in the blood, the secretion of FSH is decreased and another pituitary hormone, luteinising hormone (LH), promotes the final maturation of the ovarian follicle, ovulation and the formation of the corpus luteum. The corpus luteum secretes progesterone as well as oestrogens, which maintain the endometrium. Increasing levels of progesterone in the blood inhibit the secretion of LH. If fertilisation does not occur, the corpus luteum degenerates and the levels of hormones in the blood decrease. All four hormones are low while the endometrium thins and sheds during menstruation.

5 What do the terms ‘menarche’ and ‘menopause’ refer to?

Answer: Menarche is the first menstrual period (onset of menstruation).

Menopause is the time when menstrual periods become irregular and eventually cease.

6 Describe how follicle-stimulating hormone and luteinising hormone regulate the male reproductive system.

Answer: Follicle-stimulating hormone stimulates the epithelial tissue of the seminiferous tubules in the testes to produce sperm, while luteinising hormone stimulates cells in the testes to secrete the hormone testosterone.

7 a Define fertilisation.

Answer: Fertilisation is the fusion of a sperm and an egg (ovum).

b Describe the events that take place in humans so that fertilisation can be achieved.

Answer: Fertilisation is achieved via sexual intercourse.

The penis must become engorged with blood to result in an erection.

The vagina is stimulated and secretes mucus from glands around the cervix. This allows easy entry of the penis.

When the erect penis becomes stimulated within the vagina, ejaculation occurs via rhythmic contractions of the epididymis, the vas deferens, the seminal vesicles and the prostate gland.

Sperm are deposited, via the penis, into the vagina. Sperm swim in the semen through the cervix, into the uterus, then through the uterus and into the uterine tube.

Also refer to Figure 16.8 on page 217.

- c Where does fertilisation normally occur?

Answer: Fertilisation usually occurs in the upper third of a uterine tube.

- d What is a zygote?

Answer: A zygote is formed when fertilisation is complete, resulting in a fertilised egg; it is the first cell of the new individual.

- 8 Describe the pathway of sperm from the seminiferous tubules to when fertilisation takes place.

Answer:

Seminiferous tubules → Epididymis → Vas deferens → Urethra
→ Vagina → Cervix → Uterus → Uterine tube

Refer to Figure 16.8 on page 217.

- 9 a Explain the need for the production of very large numbers of sperm in order for fertilisation to take place.

Answer: The large number of sperm is necessary because there is a high sperm mortality rate in the vagina and uterus. In addition, the amount of enzyme in the head of one sperm cannot by itself break down the acid holding the cells of the corona radiata around the ovum. The enzyme from many thousands of sperm is required.

- b Besides sperm, what other components make up the semen?

Answer: Semen is composed of sperm and secretions from the seminal vesicles (a nourishing thick fluid), secretions from the bulbo-urethral glands, the prostate gland and enzymes that activate the sperm once ejaculation has occurred.

- 10 a What are 'secondary sexual characteristics'?

Answer: Secondary sexual characteristics are those that are associated with a person's sex, but not directly involved in reproduction.

- b Briefly describe the development of secondary sexual characteristics in both males and females.

Answer:

Female	Male
The enlargement of breasts and broadening of the hips (due to pelvic bone growth and fat deposition)	Hair growth in armpits and groin area (darker, thicker, curlier)
Hair growth in armpits and groin area (darker, thicker, curlier)	Facial, chest and back hair growth
	Increase in larynx size and lengthening of vocal cords – deepening in voice and voice may break

Students may also show the answer as a list rather than in table format.

Apply your knowledge

- 1 Can a woman become pregnant the first time she has sexual intercourse? Explain.

Answer: Yes, as long as she has ovulated and fertilisation takes place.

- 2 Explain how the human male and female reproductive organs are arranged so that sperm can be transferred from the body of the male to the female for fertilisation to occur.

Answer: The transfer is possible because the erect penis is inserted into the vagina. The ejaculation of sperm is an upward motion and the sperm swim up the cervix and uterus into the uterine tubes. Once ovulation has occurred, the egg moves down the uterine tube towards the sperm. The male has glands that produce semen, in which sperm can swim through the reproductive tract of the female.

See also Figure 16.8 on page 217.

- 3 Animals that breed in water, such as crayfish, fish and frogs, have no penis or vagina. Explain the advantages of these organs to a mammal, such as a human.

Answer: Having a penis and vagina means that there can be internal fertilisation and sperm transfer does not have to take place in water. Sperm are transferred directly from the male to the female with no chance of drying out or being washed away by water currents. This allows a smaller number of gametes to be produced. Internal fertilisation increases the chance of a sperm and egg fusing to produce a zygote.

- 4 Draw a diagram of the female reproductive system and mark in the:

- place where sperm are deposited
- site where fertilisation takes place
- path taken by the sperm to unite with the egg
- path the egg follows to unite with the sperm.

Answer: For all questions (a, b, c and d), refer to Figure 16.8 on page 217.

- 5 Although most books refer to a 28-day menstrual cycle, only about 30% of women have a cycle of this length, and for many the cycle is irregular. What factors could affect the length of the menstrual cycle? List as many reasons as possible to support your answer.

Answer: Students should mention at least some of the following. Factors affecting the length of a menstrual cycle include:

- the production of different amounts of hormones by different individuals
- the length of time the hormone is present
- stress
- excessive alcohol consumption
- smoking
- dieting, extreme weight loss and eating disorders
- medication
- regular strenuous activity, such as training for a sport.

- 6 List the following events in the order in which they would occur in the female body: ovulation; the endometrium begins to thicken; formation of the corpus luteum; a follicle begins to develop; uterine bleeding; egg travels down the uterine tube; follicle approaches maturity; degeneration of the corpus luteum; breakdown of unfertilised egg; the development of the mature follicle; deterioration of the endometrium.

Answer: The order in which they would occur is:

- a a follicle begins to develop
- b the endometrium begins to thicken
- c follicle approaches maturity
- d the development of the mature follicle
- e ovulation
- f egg travels down the uterine tube
- g breakdown of unfertilised egg
- h formation of the corpus luteum
- i degeneration of the corpus luteum
- j deterioration of the endometrium
- k uterine bleeding.