This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 05
27APR2026

Do NOT write in this box. Your MARK will be placed here.

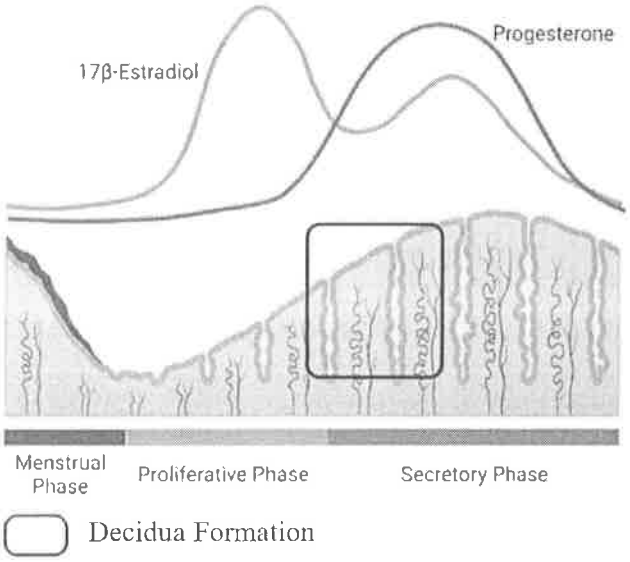
Subject :	Biology	
Class :	12E	
Teacher :	Christine Khalil	
Duration :	1 hour	
Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

The decidua, a "nursery" for an embryo

Decidualization is the process where the lining of the uterus (endometrium) undergoes a transformation under the influence of the hormone progesterone to create a nurturing and supportive environment (the decidua) that controls how deeply the embryo implants and protects it from the mother's immune system. If pregnancy doesn't happen, this prepared layer is shed during menstruation.

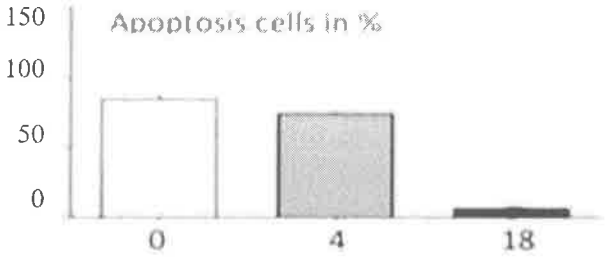
Document 1 shows the influence of the ovarian hormones, estrogen and progesterone, on the uterine lining.



Document 1

1. Name the cells which are at the origin of the ovarian hormone's secretion. (1)
2. Identify, based on document 1, which ovarian hormone is responsible for the decidua formation. (3)
3. Explain based on your acquired knowledge why estrogen is secreted first. (1)

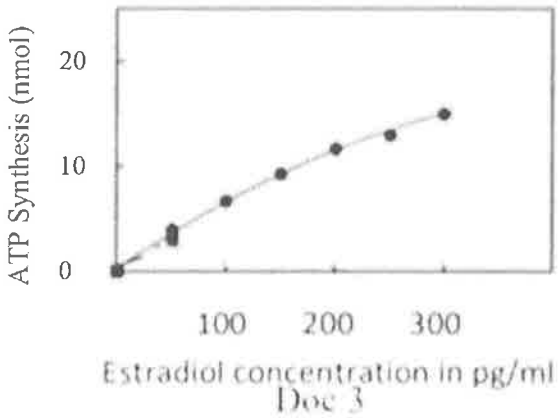
Apoptosis (programmed cell death) in the endometrial lining is heavily regulated by progesterone. Apoptosis facilitates the shedding of the endometrium during menstruation. Document 2 shows the percentage of apoptosis of the glandular endometrial cells with different levels of progesterone.



Doc 2

4. Show that the drop of progesterone at the end of the menstrual cycle triggers the shedding of the endometrium. (2)

Mitochondria play a crucial role in the regeneration of the endometrium, particularly in repairing damaged tissue after menstruation. Mitochondria support the high energy demands of endometrial cells to proliferate by providing them with the necessary energy such as ATP. Document 3 shows the ATP production in endometrial cells as a function of the estradiol level.



Doc 3

5. Interpret the results of document 3. (1.5)
6. Conclude the role of estradiol. (1)

Asherman's syndrome is characterized by a damaged basal layer of the endometrium, often caused by trauma, resulting in scarring and reduced endometrial thickness that often leads to infertility and absence of menstrual period (all what preceded is referred to as amenorrhea).

7. Indicate the relation between amenorrhea and infertility. (2)

Researches into treating Asherman's syndrome indicate that if estrogen hormone support is accompanied with transferring healthy mitochondria into a damaged uterus, fertility is restored.

8. Verify that mitochondria transfer is used to promote healing and improve fertility. (1.5)

Answer Key for SE05 Biology 12E

1. Theca interna and granulosa cells secrete estrogen. Luteal cells of the yellow body secrete estrogen and progesterone. (1)
2. At the beginning of the menstrual cycle, menstruation appears when ovarian hormones are very low; however, as estrogen hormone shows its first elevation during the proliferative phase, the endometrium proliferates. Moreover, when estrogen shows its second elevation accompanied with the unique elevation of progesterone during the secretory phase, decidua is formed. This indicates that progesterone is the ovarian hormone responsible for decidua formation. (3)
3. Estrogen acts as the essential first step to ensure that when progesterone levels rise after ovulation, the target tissues have enough receptors to fully respond, allowing the uterus to shift from a growth phase to a receptive, secretory phase. (1)
4. The percentage of apoptosis of glandular cells was 80% in the total absence of progesterone but as the level of progesterone increases from 4 till 18 ng/ml, the percentage of apoptosis of cells decreases from 75 till 10%. This indicates that progesterone inhibits the death of glandular cells. This shows that at the end of the menstrual cycle, the drop in progesterone leads to apoptosis of endometrial cells that triggers its shedding. (2)
5. ATP synthesis in mitochondria of endometrial cells increases from 0 till 16 nmol as the estrogen concentration increases from 0 till 300 pg/ml. This indicates that estrogen triggers the production of energy. (1.5)
6. Estrogen triggers mitochondria to support the high energy demands of endometrial cells to proliferate. (1)
7. Amenorrhea appears when the endometrium doesn't develop and thus doesn't shed. This implies an impairment of implantation which is the main cause of infertility. (2)
8. Mitochondria improve the uterine development and enhance endometrial stem cell function, so proliferation will be followed by decidua formation that controls implantation. This verifies that mitochondria transfer is used to promote healing and improve fertility. (1.5)