مسابقة في مادة علوم الحياة
المدة ثلاث ساعات

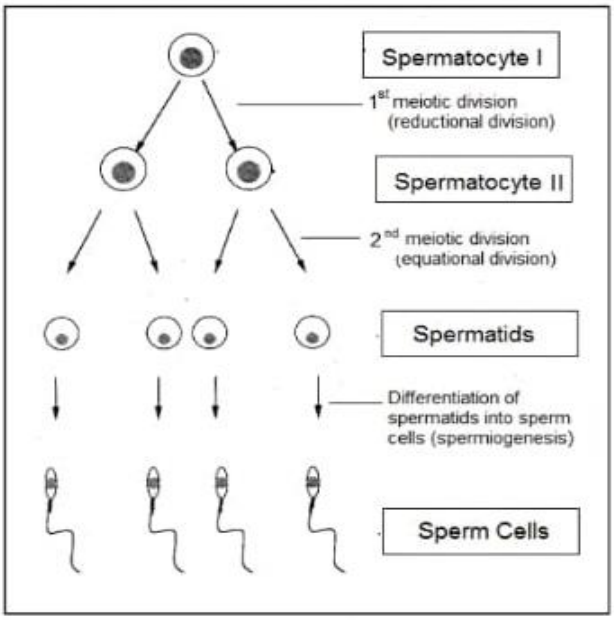
الاسم:
الرقم:

Answer the following exercises.

Exercise 1 (5 Pts)

Mr. X and Mr. Y are two adult sterile men. We perform different tests to specify the origin of this defect.

Document 1 shows certain stages of spermatogenesis. The germ cells, whose names are framed in boxes, are found in the wall of the seminiferous tubules.

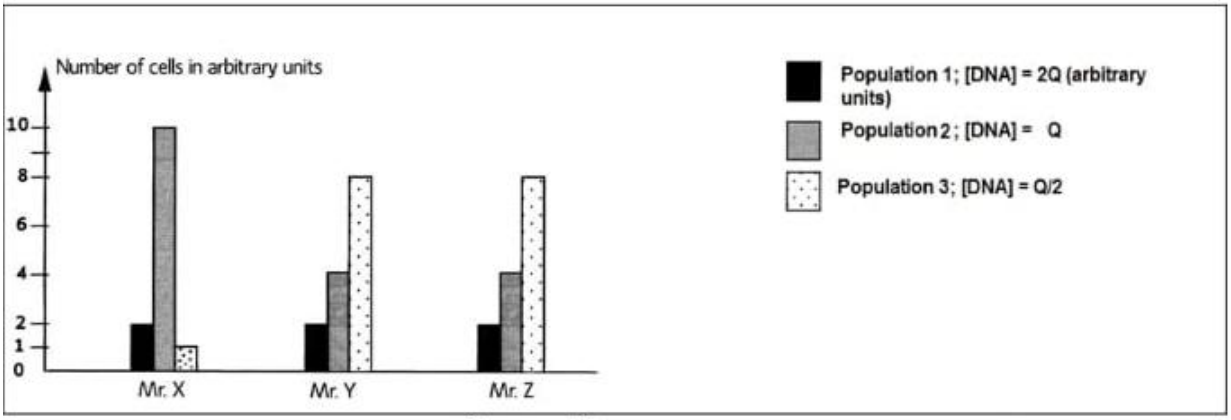


Document 1

1- Describe the different stages of spermatogenesis represented in document 1.

We perform a quantitative study for the amount of DNA of the germ cells extracted directly, by biopsy, from a fragment of the testicles of these two sterile men and that of a fertile man Mr. Z. Three different populations of germ cells are obtained. The number of each cell population, as well as the amount of DNA in each of them are shown in document 2.

2- Indicate the germ cells corresponding to each of the three populations shown in document 2. Justify the answer.



Document 2

3- Explain the variation of the number of germ cells of the three populations in the fertile man Mr. Z.

4- Determine, by referring to document 2, the cause of sterility of Mr. X.

Microscopic observations of the semen of Mr. Y showed sperm cells, where the majority of these cells showed an aspect identical to that schematized in document 3.

Doc.3

5- Explain the origin of the sterility of Mr.Y.

Exercise 1 (5 Pts)

1- During the first meiotic division (reductional division), spermatocyte I produces two spermatocytes II that are subjected to the second meiotic division (equational division) , each producing two spermatids. Then, the spermatids differentiate into sperm cells (spermiogenesis). **(1/2 pt)**

2- Population 1 corresponds to spermatocytes I because the quantity Q is duplicated during the S phase of interphase and becomes 2Q in spermatocyte I that has 2n chromosomes of 2 chromatids each.**(½ pt)**
Population 2 corresponds to spermatocytes II because after the reductional division of meiosis we obtain spermatocytes II that have n chromosomes each of 2 chromatids corresponding to the quantity Q of DNA.**(½ pt)**
Population 3 corresponds to spermatids or sperm cells because after the equational division of meiosis, we obtain 4 cells (spermatids) each having n chromosomes of one chromatid each corresponding to the quantity Q/2 of DNA. This same quantity remains constant after spermiogenesis that gives sperm cells. **(½ pt.)**

3- In the fertile man, the number of germ cells is doubled from 2 to 4 then to 8 passing from population 1 to population 3 because the number of cells is doubled after each meiotic division. Each spermatocyte I produces 2 spermatocytes II and each spermatocyte II produces 2 spermatids (1-2-4) **(1/2 pt)**

4- In the sterile man X, the number of spermatocytes I is the same as in the fertile man (2 a.u.), but the number of spermatocytes II in the sterile man is much higher than that in the fertile man (10 a.u >4 a.u) . On the other hand, the number of spermatids or sperm cells in the sterile man is abnormally lower than that in the fertile man (1 AU < 8 AU). Therefore, not all spermatocytes II had divided into spermatids during meiosis. Hence, the cause of sterility in man X is an abnormal meiosis, which is blocked at the stage of spermatocytes II leading to an insufficient number of sperm cells (oligospermy) **(1 pt)**

5- Document 2 reveals that in the sterile man Y, the number of cells of the three populations is the same as in the fertile man Z; this indicates that meiosis took place normally in man Y, that is why he has a normal number of spermatids and sperm cells, therefore, oligospermy did not happen . **(1/2 pt)** On the other hand, document 3 reveals one type of sperm cell that has a normal flagellum and a normal head, but the middle piece is larger than in the normal sperm cell. This is due to the non elimination of residual cytoplasm **.(½ pt)** Hence, the origin of sterility of man Y is the abnormal spermiogenesis **(1/2 pt)**