In his Name

Al-Mahdi High School – Al Hadath

First Trial
Life Science Test

AY: 2017/2018

Duration: 180 min

Score: /20

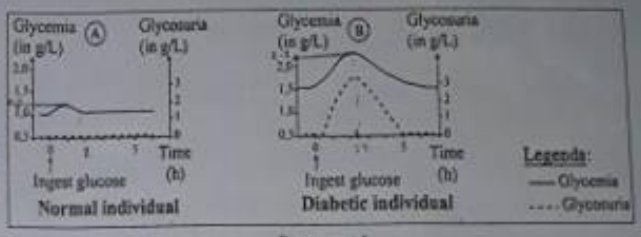
Name: Saukaina Youness Grade 12 (L S) Date: 23/ 11 / 2017

Exercise 1 (5 points) **Type of Diabetes**

The orally provoked hyperglycemia test consists of giving an individual a solution containing 50g of glucose. This test is performed on a healthy individual and on another diabetic one. The variations of glycemia and glycosuria are measured and the obtained results are presented in document 1.

1- Draw out the normal value of glycemia and that of glycosuria in a normal individual.

2- Compare the variations of glycemia in the two individuals, the normal one and the diabetic one, as well as the variations of glycosuria.



Document 1

In order to understand the mechanism involved in the regulation revealed, a series of experiments are performed:

Experiment 1: 3 rats A, B, and C are taken. B and C are injected with different substances and the evolution of their glycemia is measured. The obtained results are presented in the table of document 2.

	Time after the injection (in min)	0	15	30	60	90
Glycemia (mg/100cm³)	A: without injection	110	105	105	100	100
	B: injection of insulin	105	90	70	60	55
	C: injection of glucagon	110	135	155	140	130

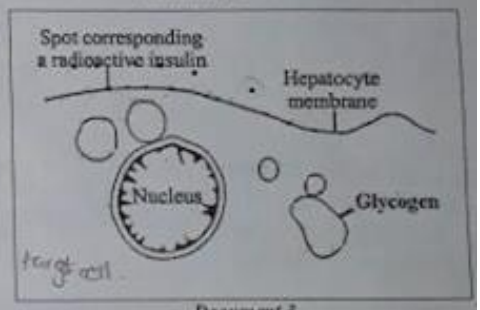
Document 2

3- Construct, on the same graph, the curves of the variation of glycemia in B and C as a function of time.

4- Interpret the obtained results in document 2.

Experiment 2: A pancreas of a rat is isolated and then perfused by a liquid of increasing concentration of glucose. An increase in the level of insulin in the liquid leaving the pancreas is noticed.

Experiment 3: Radioactive insulin is injected into a healthy individual in order to identify its destination in the organism. The obtained result is shown in document 3.



Document 3

5- Explain the mechanism of regulation revealed in experiments 2 and 3.

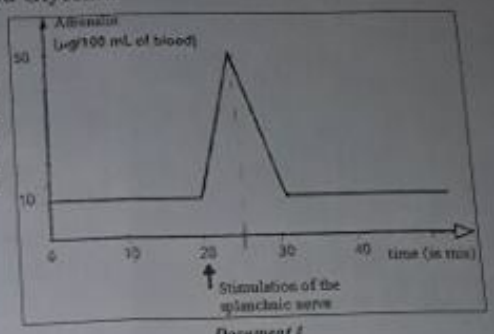
Experiment 4: Experiment 3 is repeated on a diabetic individual. The obtained results are the same as those observed in the healthy individual.

6- Determine the probable origin of diabetes in this individual.

Exercise 2 (5 points) **Adrenalin and Glycemia**

Humans are sensitive to stress, fear, anger, and many other nervous stimuli. These stimuli activate the pituitary-adrenal system. In the framework of studying this phenomenon, the splanchnic nerve originating from the hypothalamus and innervating the adrenal medulla is stimulated. Document 1 shows the variation of the concentration of adrenalin after the stimulation of the splanchnic nerve.

1- Interpret document 1.

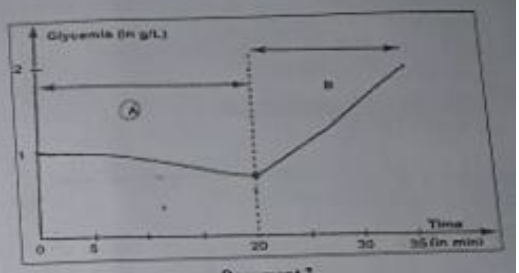


Document 1

It is recommended by doctors that people with diabetes should avoid stress. To understand this advice as well as the relationship between stress and hyperglycemia, an experiment is performed: the liver of an animal is isolated then infused with:

- First: a physiological solution (A).
- Second: a physiological solution (B) containing adrenalin.

Document 2 shows the variation of glycemia in the subhepatic vein during the two infusions (A) and (B).



Document 2

2- Explain, using documents 1 and 2, the advice given by doctors to people with diabetes.

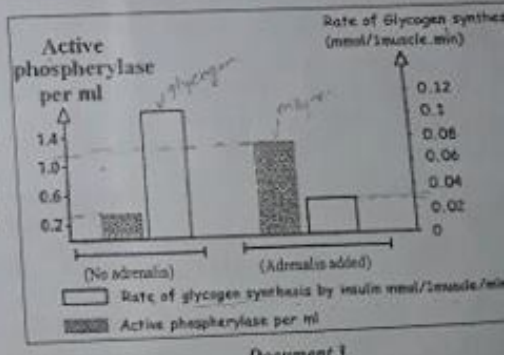
glycogen → glucose

Glycogen phosphorylase is the main enzyme in glycogenolysis. In order to study the relationship between adrenalin and glycogen phosphorylase, hepatic cells are cultured in 2 media: one without adrenalin and one to which adrenalin is added. The results obtained are shown in document 3.

3- Define glycogenolysis and give the chemical formula of glucose and glycogen.

4- Determine, using document 3, the mode of action of adrenaline in glycemia regulation.

5- Using all what preceded; construct a functional diagram showing the regulation of glycemia by adrenalin.



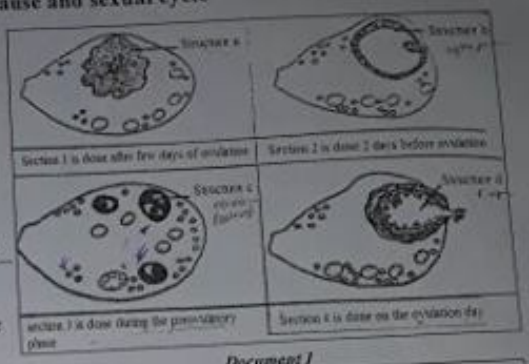
Document 3

Exercise 3 (5 points) **Menopause and sexual cycle**

A) It is proposed to study some aspects of the ovarian functioning in women. Document 1 includes sections of ovaries at different moments of the sexual cycle. The sections show different structures designated by the letters a, b, c and d.

1- Give the name of structures a, b, c and d.

2- Arrange these structures in the chronological order of their appearance in a sexual cycle.

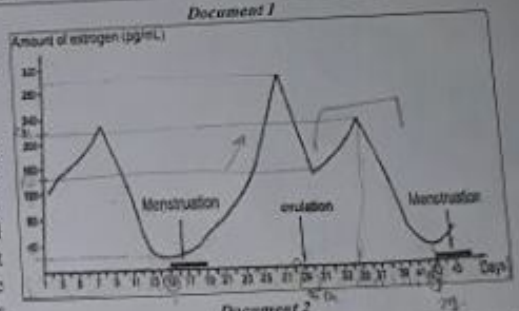


Document 1

We measure the blood estrogen in a woman for 45 days. Document 2 shows the results obtained.

3- Identify the first day of the cycle and the duration of this cycle.

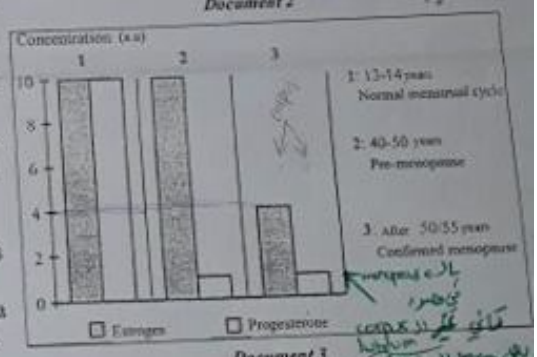
4- Show, referring to documents 1 and 2, the relationship between the variation of estrogen during the sexual cycle and the evolution of the ovarian structures.



Document 2

B) Menopause is the interruption of cycles between the age of 40 and 55 years. It takes place in two steps: the pre-menopause and confirmed menopause. The pre-menopause which lasts several months is characterized by the succession of irregular cycles with or without ovulation. On the other hand, confirmed menopause arrives after the pre-menopause. Where cycles disappear and the blood level of gonadotrophins is very high.

Document 3 shows plasma levels of estrogen and progesterone from puberty until menopause.



Document 3

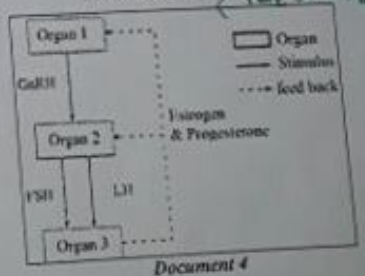
5- Indicate, based on your knowledge, which structures of document 1 is present in the ovaries of a confirmed menopausal woman.

6- Analyze document 3.

7- Formulate a hypothesis that explains the results obtained during the pre-menopause.

8- Explain, with reference to document 3, why a confirmed menopausal woman cannot get pregnant.

Document 4 represents hormonal regulation in a woman.



Document 4

9- Based on the acquired knowledge:

9.1- Give the name of organs 1, 2, and 3.

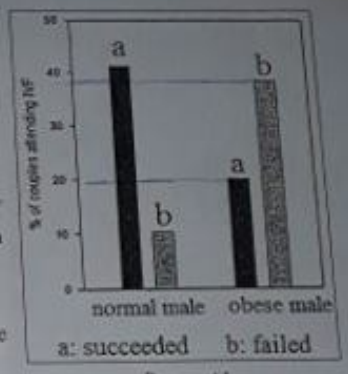
9.2- Indicate the effect of FSH and LH on the organ 3.

10- Explain the increase in gonadotropin during confirmed menopause.

Exercise 4 (5 points) **Obesity and infertility**

Obesity is characterized by a significant accumulation of lipids and is accompanied by changes of cellular functions. For researchers, it was always a concern to investigate the influence of obesity on the functioning of the body systems including the reproductive one.

A statistical study is performed on couples who failed to conceive and performed IVF followed by ET. Among the couples participating in the study, all females are of normal weight while some males are of normal weight and others are obese. The results of the study are shown in document 1.



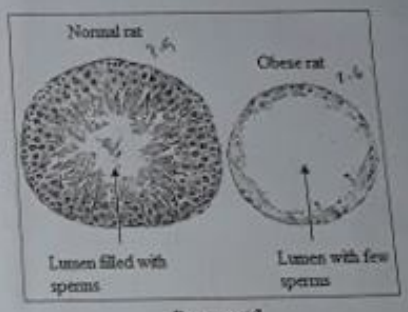
Document 1

1- Show that male obesity and infertility are related.
2- Formulate a hypothesis about the cause of infertility in obese males.

In order to investigate the cause of infertility of obese males, several experiments are performed on male rats.

Experiment 1:

Male rats are fed with high fat diet to induce obesity. The cross section of the seminiferous tubules of these rats is then compared to that of healthy rats of normal weight. The obtained results are shown in document 2.

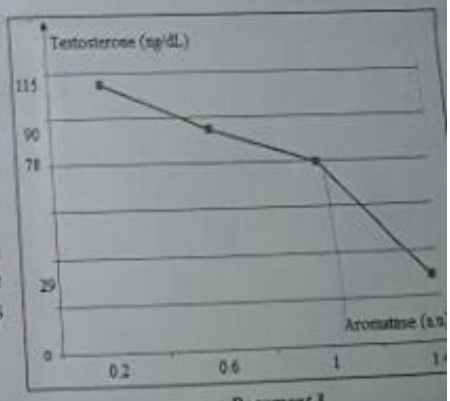


Document 2

3.1- Compare the 2 sections obtained in experiment 1.
3.2- Draw out a conclusion.

Experiment 2:

Cells of the adipose tissue of obese rats are crushed and the extracts of these cells are studied. An enzyme named aromatase is identified. This enzyme is then added to leydig cells in a culture medium. The testosterone level in the culture medium is then measured. The results obtained are shown in document 3.



Document 3

4.1- Give the location and the function of leydig cells.
4.2- Interpret the results obtained in document 3.

Experiment 3:

To investigate the mode of action of the enzyme aromatase, both aromatase and testosterone are mixed in a test tube. After a while testosterone is no longer detected in the test tube. And estrogen is found in the test tube instead.

5- Referring to all preceding documents, explain the effect of obesity on male fertility.