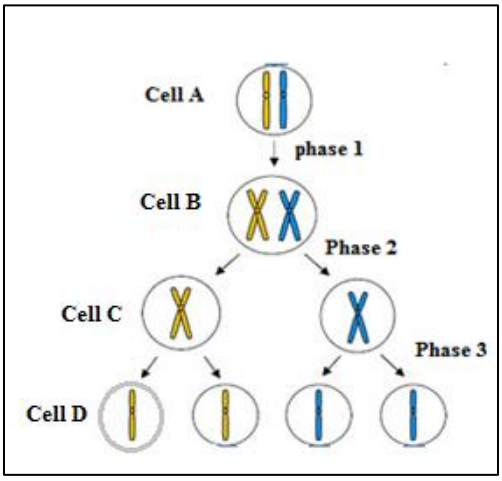
المركز التربوي للبحوث والإنماء	الهيئة الأكاديميّة المشتركة قسم: العلوم	**الشهادة: المتوسطة** **مادّة: علوم الحياة والأرض** **نموذج رقم -١-** **المدة : ساعة واحدة**

نموذج مسابقة (يراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي ٢٠١٦-٢٠١٧ وحتى صدور المناهج المطوّرة)

Exercise 1 (4 pts) Cell division



The adjacent document shows a cell A undergoing cellular division. For simplicity, only one pair of chromosomes is considered.

Indicate, by referring to the document, the true or false statement(s). Justify the answer.

1. Cell A undergoes mitosis.
2. Phase 1 corresponds to interphase.
3. The number of chromosomes in cell B is doubled by the end of phase 2.

Exercise2 (6 pts) The Role of Kidneys

In the framework of studying the role of the kidneys, a normal individual is fed a meal poor in proteins during one day and a meal rich in proteins during another day. The amount of urea in the blood as well as in the urine is measured in each case. The results are presented in document 1.

	Diet poor in proteins	Diet rich in proteins
Amount of urea in blood (g/L)	**0.07**	**0.4**
Amount of urea in the urine(g/L)	**7**	**35**

Document 1

1. Determine, by referring to document 1, the origin of urea in blood and urine.

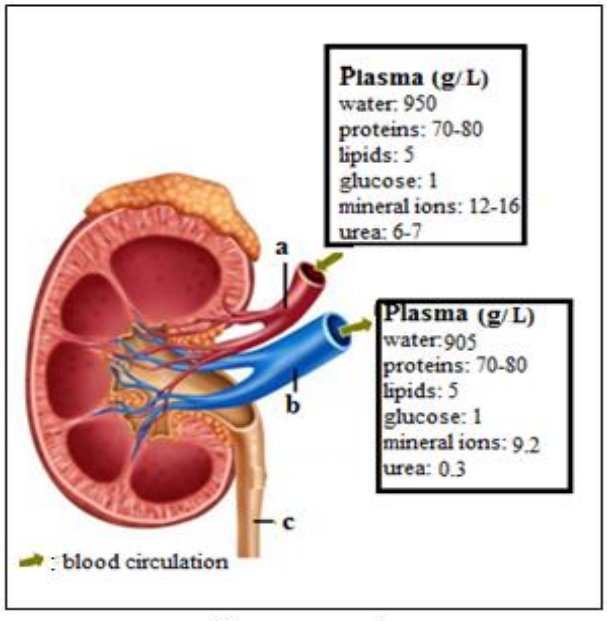
Document 2 shows a longitudinal section of a kidney as well as the concentration of the constituents of the blood plasma in blood vessels a and b.

2. Label the structures a, b, and c.

3.1 Compare the concentration of each of the constituents in blood entering and leaving the kidneys.

3.2 What do you conclude concerning the role of kidneys?

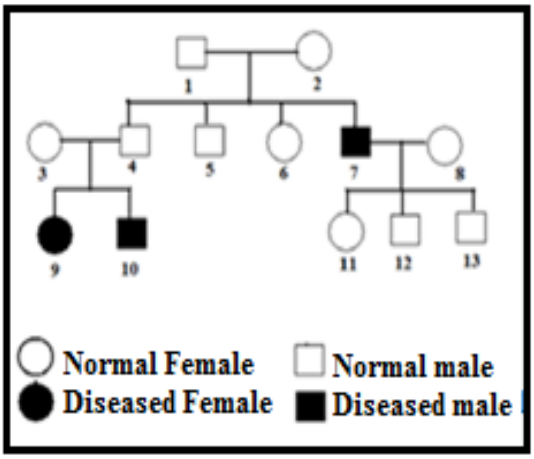
4. Do you advise a man whose kidneys are not functioning normally to eat a meal rich in proteins? Justify the answer.



Document 2

Exercise 3 (5 pts) Inheritance of Sickle Cell Anemia

Sickle cell anemia is a hereditary disease characterized by the synthesis of abnormal hemoglobin. It is due to a gene located on the pair of chromosomes number 11.The adjacent document shows the genealogical tree of a family which some of its members are affected with this disease.



1. Specify if the allele which is responsible for this disease is dominant or recessive.
2. Designate by symbols the corresponding alleles.
3. Indicate the genotypes of each of the individuals, 1and 11. Justify your answer.

   Female 9 marries a homozygous normal male.

4. Show that all children of female 9 will be healthy, not diseased.

Exercise 4 (5 pts) Digestion of Proteins

After ingesting a meal rich in proteins, a probe is introduced into the digestive tube of a mouse. Samples of the ingested food are extracted from four organs constituting the digestive tube. The concentrations of proteins and amino acids present in these four samples are measured. The results are shown in the table below.

	Digestive Tube			
Concentration (%)	**Mouth**	**Esophagus**	**Stomach**	**Small Intestine**
Proteins	100	100	75	0
Amino acids	0	0	0	100

1. Construct a histogram that represents the variation of the concentrations of proteins and amino acids along digestive tube of a mouse.
2. Determine the organ where the chemical digestion of proteins starts and where it ends.

3.1 Name one protease which is present in the stomach.
3.2 What is the role of this protease?

In the framework of a study that monitors the fate of the ingested proteins, a mouse is fed proteins marked with radioactive nitrogen. Few days later, radioactive proteins were detected at the level of the muscles and in other organs.

4. Explain the results of this study.

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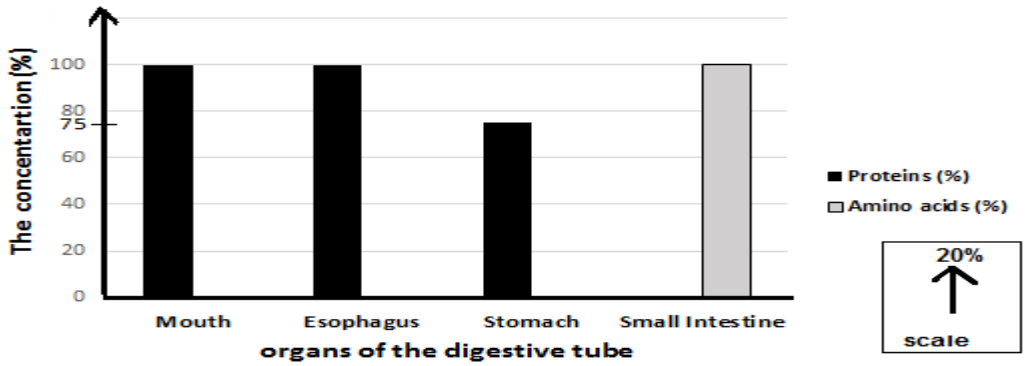
أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي 2016 - 2017 وحتى صدور المناهج المطوّرة)

Ex	part	Exercise 1 (4 points)	Mark
1	1	False. **Justification:** B cell having 2 chromosomes gives, after two successive divisions (phase 2 and phase 3), 4 daughter cells, D cells each having one chromosome. Therefore, the number of chromosomes is reduced by half, and this corresponds to meiosis.	**0.5** **0.75**
	2	True **Justification:** Because the chromosomes each of 1 chromatid in cell A become chromosomes each of 2 chromatids in cell B. So, there is a duplication of the chromosomes which is a characteristic of the S phase of the interphase.	**0.75** **0.75**
	3	False **Justification:** The 2 homologous chromosomes of the same pair in cell B separate to each of the daughter cells C. So, there is a reduction in the number of chromosomes and not doubling.	**0.5** **0.75**

		Exercise 2 (6 points)	
2	1	The quantity of urea increases from 0.07 g/l to 0.4 g/L in blood and from 7 g/L to 35 g/L in urine upon shifting from a diet poor in proteins to a diet rich in proteins. So, the origin of urea in blood and urine is the ingested protein.	**1**
	2	a: renal artery b: renal vein c: ureter	**0.5** **0.5** **0.5**
	3.1	The concentration of proteins (70 to 80 g/l), that of lipids (5g/l) and that of glucose (1g/l) stay the same in blood entering and leaving the kidney. The concentration of water (950 g/l) in blood entering the kidney is higher than that in blood leaving the kidney (905 g/l). The concentration of mineral ions (12-16g/l) in blood entering the kidney is higher than that in blood leaving the kidney (9.2 g/l). Similarly, the concentration of urea in blood entering the kidney (6 to 7 g/l) is much higher than that in blood leaving the kidney (0.3 g/l)	**1.5**
	3.2	The kidney plays a role of purification of blood by eliminating the excess of water, mineral ions and urea.	**0.5**
	4	No, since a high-protein diet increases the concentration of urea, a toxic substance, in the blood; and since the kidneys which are responsible for eliminating excess urea from the blood, are no longer functional in this man, then, urea is no longer eliminated and it accumulates in blood. This leads to health problems.	**0.5** **1**

		Exercise 3 (5 points)	
3	1	The allele responsible for this disease is recessive because the normal couples 1&2 give birth to a diseased boy 7. This means that the allele of the disease is present in the parents but it is masked and not expressed phenotypically.	0.75
	2	Let N be the symbol of the dominant allele which is responsible for the normal phenotype. Let s be the symbol of the allele which is responsible for the disease sickle cell anemia and it is recessive.	0.5
	3	The genotype of individual 1 is Ns. Since individual 1 shows a normal phenotype, he possesses the dominant allele N and since he has an affected child 7 of recessive phenotype, whose genotype is ss. So, he inherits an allele s from each of his parents 1 and 2. Therefore, father 1 possesses allele s and he is heterozygous. The genotype of individual 11 is Ns. Since she is normal, she possesses the dominant allele N. Her father 7 is diseased, recessive phenotype, then his genotype is ss. He gives his children only the allele s. So female 11 possesses also allele s and she is heterozygous.	1.25 1.25
	4	Female 9 is diseased; this trait is recessive and is only expressed in people who are homozygous for this trait. This means that her genotype is ss and she gives her children only the recessive allele s. If this female marries a normal male who is homozygous of genotype NN, this male gives his children only one type of allele N which is dominant. Thus all children will be heterozygous, of genotype Nm, and since allele N is only expressed phenotypically then all the children of this woman will be normal.	1.25

		Exercise 4 (5 points)	
4	1	Histogram showing the variation of the concentration of proteins and amino acids in different digestive organs 	2
	2	The concentration of proteins starts to decrease only at the level of the stomach to reach 75%; therefore the digestion of proteins starts in the stomach. The amino acids appear only at the level of the small intestine with a concentration of 100%; However, proteins at this level disappear with a concentration of 0%. This means that the proteins are completely transformed into amino acids in the small intestine indicating the end of their digestion. So, digestion of proteins ends at the level of the small intestine.	1
	3.1	Pepsin	0.5
	3.2	The role of pepsin is to catalyze the degradation of proteins into peptides.	0.5
	4	The amino acid molecules resulting from the complete digestion of radioactive proteins are absorbed by blood at the level of the small intestine of a mouse. These radioactive amino acids are distributed to muscles and other body organs where they undergo assimilation. This results in the production of a new form of proteins specific to mice.	1