

Exercise 1: (5.5 points)

Regulation of Body Fluids

Blood and Lymph are two types of body fluids. The lymph bathes the body cells and is present in lymphatic vessels, while blood is present in the blood vessels. The composition of these fluids is constantly submitted to variations due to food supply and cellular activities. However, this composition is maintained constant due to the intervention of regulatory systems.

- **1.** Pick out from the text:
 - **1.1** Two body fluids and their locations.

1.2 The factors that modify the composition of these fluids.

In order to study the role of the kidneys in the regulation of the composition of the body fluids, the following study is performed.

A normal individual is fed a meal poor in salt for 3 consecutive days followed by a meal rich in salt (10g NaCl/day) for 3 other consecutive days.

The concentrations of NaCl in the blood leaving the kidneys and that eliminated in the urine are measured in each case. The results are presented in the adjacent document.

- **2.** Name the blood vessel that carries blood:
 - **2.1** Towards the kidney
 - **2.2** Away from the kidney.
- 3. Draw the graph showing the variation of the quantity of salt eliminated in the urine as function of time following the ingestion of the two meals.

4.1 Analyze the obtained results presented in the adjacent document.

4.2 What can you conclude concerning the role of the kidney?

Exercise 2: (5 points)

Meal poor in salt Meal rich in salt Time (days) 1 2 3 4 5 6 Concentration of NaCl in the blood 3.2 3.2 3.2 3.2 3.3 3.2 leaving the kidney (g/l)Quantity of salt 50 eliminated in the 50 50 75 100 150 urine (mmol/24 hr)

Achondroplasia, a Genetic Disorder

Achondroplasia is a genetic disorder that results in dwarfism. The gene responsible for this disease is localized on chromosome 4.

Jad and his brother Fouad, like their parents, are affected with achondroplasia, but their sister Lara is not and she has a normal height. Jad marries a normal woman, they give birth to an unaffected boy.

- **1.** Construct the pedigree of Jad's family using the legends shown in the adjacent document.
- **2.** Determine if the allele responsible for achondroplasia is dominant or recessive.
- **3.** Designate by symbols the corresponding alleles.
- **4.1** Indicate the genotypes of Jad and his son.
- **4.2** Schematize the pair of chromosomes 4 of Jad and that of his child with the corresponding alleles.

Jad's wife is pregnant and they are worried about having an affected child.

5. Determine by factorial analysis, the proportion of obtaining a child with achondroplasia by this couple.



Exercise 3: (5 points)

Role of the Small Intestine

The ingested food passes through out different organs of the digestive tract. Digestive enzymes secreted by digested glands allow the food transformation into nutrients.

The concentration of glucose is measured in the blood entering and leaving four different organs of the digestive tract, following the ingestion of a meal rich in glucose. The obtained results are shown in document 1.

1. Show that the small intestine is the organ where absorption of glucose takes place.

In order to find out one of the features that makes the small intestine a structure well adapted for absorption, the surface areas of the external and the inner walls of a section of the small intestine are measured. The results are presented in document 2.

2.1 Compare, by referring to the small intestine structure in document 2, the aspect of the external wall and that of the inner wall of the small intestine.

2.2 Compare the surface area of the different structures presented in document 2.

- **2.3** What can you draw out?
- **3.** Indicate two other characteristics of the inner wall of the small intestine.

Exercise 4: (4.5 points)

Anemia a Blood Disorder

Number of red blood

 $\frac{\text{cells x } 10^{6}/\text{mm}^{3} \text{ of blood}}{\text{Level of hemoglobin in}}$

the blood (g/dl)

Blood circulates in blood vessels throughout the body, it delivers oxygen gas and nutrients to the cells and carries away carbon dioxide and wastes products such as urea. Some persons suffers from anemia which is a blood disorder, the most common symptoms of this disorder are: shortness of breath, fatigue, pale skin, etc...

- **1.** Pick out from the text:
 - **1.1** The substances consumed by the cells.
 - **1.2** Two symptoms of anemia.

The number of red blood cells and the level hemoglobin in the blood are measured in a normal individual and in an anemic individual. The results are shown in the adjacent document.

2. State the role of hemoglobin.

3.1 Compare the obtained results presented in the adjacent document.

- 3.2 Conclude two features of anemia.
- 4. Explain why anemic persons suffer from fatigue.

	Concentration of glucose (g/l)					
Organ	Blood entering	Blood leaving				
	the organ	the organ				
Esophagus	1	0.9				
Stomach	1	0.7				
Small intestine	1	2.6				
Large intestine	1	0.8				

Document 1



Document 2

Normal

individual

4.5

13

Anemic

individual

3.5

7

المادة: علوم الحياة والارض ـ لغة إنكليزية		
الشهادة: المتوسطة	الهيئة الأكاديميّة المشتركة	
نموذج رقم 2019/1	قسم : العلوم	المركز التربوي
المدّة : ساعة واحدة		

Ex	Part	Exercise 1 (5.5 points)			
		Regulation of the Body Fluids	IVIAI K		
	1.1	Blood and lymph are two types of body fluids. The blood is present in the blood vessels. The lymph bathes the body cells and is present in lymphatic vessel.			
	1.2	The composition of these fluids is constantly submitted to variations due to food supply and cellular activities.			
	2.1	The renal artery.			
	2.2	The renal vein.	0.25		
1	3	Title: graph showing the variation of the quantity of salt eliminated in the urine as function of time following the ingestion of the two meals. Amount of salt eliminated in theurine (mmol/24 hr)1401201008075076076076076076076076076076076	2		
	4.1	The concentration of NaCl in the blood leaving the kidney (3.2 g/l) and the quantity of salt eliminated in the urine (50 mmol/24 hr) are maintained constant during the three days when the normal individual is supplied with a meal poor in salt. However, when this individual is supplied with a meal rich in salt for the other three consecutive days, the concentration of NaCl in the blood leaving the kidneys remains nearly constant (around 3.2 g/l), while the quantity of salt eliminated in the urine increases from 50 mmol/24 hr.			
	4.2	The kidneys play a regulatory role, they maintain the composition of blood constant by	0.5		
Ex	Part	eliminating the excess salt in the urine.			
	I ul t	Achondroplasia, a Genetic Disorder			
	1	Pedigree of Jad's family I I Jad Fouad Lara Pedigree of Jad's family Legend: ONormal woman Affected woman Mormal man Affected man	0.75		
2	2	The parents of Jad are both affected with achondroplasia but they give birth to an unaffected girl (Lara); this means that the normal allele is present in both parents but masked by the allele responsible for achondroplasia and not expressed phenotypically. Hence, the allele responsible for achondroplasia is dominant with respect to the normal allele.	0.75		

	3	Let "A" be the symbol of the dominant allele which is responsible for achondroplasia			
		disorder.			
		Let "a" be the symbol of the recessive allele which is responsible for the normal			
	4.1	phenotype.			
	4.1	The genotype of Jad. A//a The genotype of Jad S child. a//a	0.5		
	4.2	4.2 The representation of chromosomes: Jad Jad's child A Jad a Jad's child Pair of Pair of Pair of chromosomes 4 characteristics			
		Parent's Phenotypes: $\partial[A]$ x $Q[a]$ Punnet square			
	5	Genotypes: $\partial A/a$ x $\varphi a/a$ Gametes: A, a a $\frac{1}{2}$ $\frac{1}{2}$ A $\frac{1}{2}$ a $\frac{1}{2}$ a $\frac{1}{2}$ a/a $\frac{1}{2}$ of the children have the genotype A//a and are of phenotype [A]. Thus, the proportion of obtaining an affected child is $\frac{1}{2}$	1.5		
Ex	Part	Exercise 3 (5 points)	M1-		
		Role of the small intestine	Mark		
	1	The concentration of glucose in the blood entering each of the esophagus, stomach, small intestine and large intestine is 1 g/l. This level decreases to 0.9 g/l, 0.7g/l and 0.8g/l in the blood leaving the esophagus, stomach and large intestine respectively, but it increases to 2.6g/l in the blood leaving the small intestine. Therefore, glucose is absorbed by blood at the level of the small intestine	1.5		
	2.1	The external wall of the small intestine is smooth however its inner wall is folded into ridges covered with villi			
3	2.2	The external surface area of a section of the small intestine (3300 cm^2) is smaller than that of the inner surface which is covered with ridges $(10\ 000\ \text{cm}^2)$. This value is considerably 10 times smaller than that covered with villi $(100000\ \text{cm}^2)$.	1		
	2.3	The villi provide the inner wall of the small intestine with a large surface area of absorption	0.5		
	3	The inner wall of the small intestine is richly vascularized.	-		
		The inner wall of the small intestine is very thin.	I		
Ex	Part	Exercise 4 (4.5 points) Anemia a Blood Disorder			
	-	1.1 Oxygen gas and nutrients are consumed by cells.	0.5		
	1	1 1.2 The symptoms of anemia are shortness of breath, fatigue or pale skin.			
	2	Hemoglobin transports the respiratory gases, oxygen gas and carbon dioxide.			
4	3.1	Both, the number of red blood cells (4.5 million/mm ³) and the level of hemoglobin (13 g/dl) in the blood of a normal individual are greater than those in an anemic individual which are 3.5 million /mm ³ of blood and 7 g/dl respectively.			
	3.2	Anemia is characterized by deficiency in red blood cells and in hemoglobin.	0.5		
	4	Oxygen gas is carried by hemoglobin molecule present in red blood cells. Anemic individual has a low number of red blood cells and hemoglobin molecules. As a result less oxygen gas is transported to body cells by blood. Consequently, a little amount of oxygen gas is consumed by the cells, resulting in low production of energy by cellular oxidation reaction. This is why the person suffers from fatigue.	1.5		