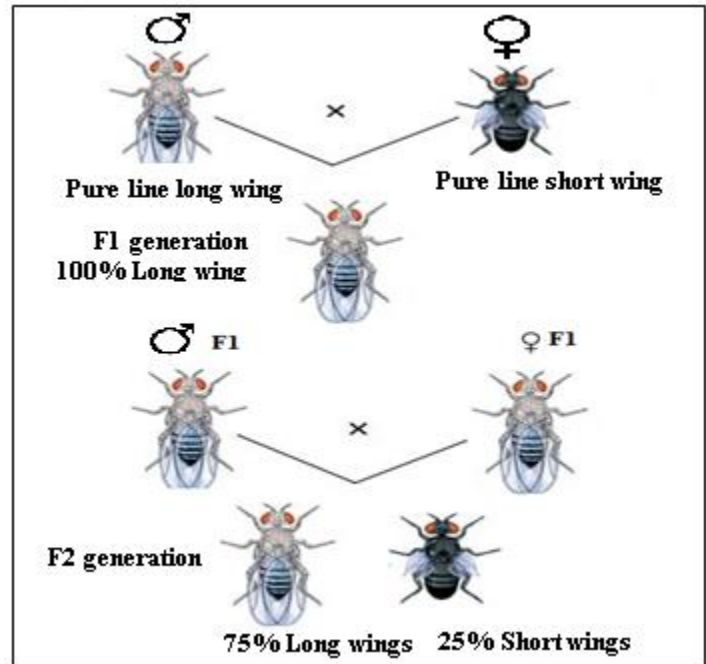


### Exercise 1: (5 points) Transmission of Hereditary Characteristics

To study the transmission of the hereditary trait: “size of the wings” in drosophila ( $2n=8$ ), we cross a pure line male drosophila with long wings with a pure line female drosophila with short wings. The adjacent document shows the results of this cross.

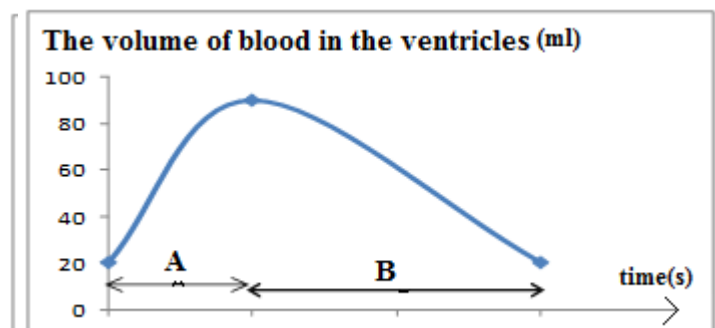


1. Identify the dominant allele.
2. Designate by symbols the corresponding alleles.
3. Indicate the genotypes of the parents and of the descendants (F1).
4. Verify, by a factorial analysis, the experimental results of F<sub>2</sub> starting from the initial parents.

### Exercise 2: (5 points)

### Cardiac Cycle and Blood Circulation

The heart is a hollow muscle (the myocardium) that pumps blood to all organs of the body including the lungs. Such cardiac activity comprises three successive phases: auricular systole, ventricular systole and general diastole. The adjacent graph shows the variation in the volume of the blood in the ventricles during the two systole phases.



1. Specify the part of the graph (A or B) that corresponds to the auricular systole and the part which corresponds to the ventricular systole.
  - 2.1 Name the two types of blood circulations.
  - 2.2 Indicate the role of each
- 3.1 How does the volume of blood ejected from the ventricles into the arteries vary, in case the myocardium is weak? Justify the answer.
  - 3.2 Explain the consequences of this variation on the body.

**Exercise 3: (5 points)****Regulatory Role of the Kidneys**

In the framework of studying a role of the kidneys, an individual who is 70 kg is subjected to the following study.

Extracellular fluid (ECF) is a fluid which surrounds all cells in the body and which forms the fluid component of the blood (plasma) and the interstitial fluid (IF). IF is a fluid that surrounds all cells not in the blood. The volumes of Extracellular fluid (ECF) as well as the urine flow are measured during 5 hours in the individual before and after ingesting 600 mL of water at the first hour. Water is absorbed to blood after 5 min of ingestion. The results are presented in the table below.

Ingestion of 600 mL of water  
↓

Time (hours)	0	1	1.5	2	3	4	5
Volume ECF (L)	14	14	14.5	14.2	14	13.8	14
Urine Flow (mL/min)	0	2	2	8	4	3	2

1. Indicate the pathway of water from the time of ingestion until absorption to blood.
2. Construct the graph that represents the variation of the urine flow as a function of time.
3. Show that the kidneys play a regulating role at the level of the organism.

During diarrhea, the body loses a lot of water through stool.

4. Propose an advice to an individual who has diarrhea to avoid its bad consequences.

**Exercise 4 (5 points)****Healthy Diet**

Anna and Alia, 2 young 11 years old females, have their lunch in the school canteen at noon. The menu of the day consists of grated carrots, green salad, steak, fried potatoes, and flan (sweet dessert)

1. Indicate the food group to which each food in the menu belongs.

The daily energy needs of each of the two girls are around 10000kJ /day and the lunch meal should provide 40% of this daily energy.

2. Calculate the daily energy that should be provided by the lunch of each of the two girls.

The adjacent document shows the energy values of the constituents of the lunch menus for each of the two girls in the school.


3. Calculate the total energy provided by the lunch meal of each of the two girls.

4.1 Determine the girl which lunch meal provides her with the proper daily energy needs

4.2 Determine the girl which lunch meal is imbalanced.

5. Propose, by referring to the document, a recommendation or an advice to the girl with unbalanced diet.

The lunch meal constituents	Energy value of the constituents of	
	"Anna" meal (in kJ)	"Alia" meal (in kJ)
Carrots	100	160
Green Salad	48	97
Steak	750	830
Fried potato	4000	2500
Flan	380	380

المادة: علوم الحياة والارض الشهادة: المتوسطة نموذج رقم -3- المدة : ساعة واحدة	الهيئة الأكاديمية المشتركة قسم : العلوم	 المركز العلمي للبحوث والابناء
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أسس التصحيح ( تراعي تعليق الدروس والتوصيف المعدل للعام الدراسي 2016 - 2017 وحتى صدور المناهج المطورة)

part	Exercise 1(5 points)	Mark																	
1	All F1 hybrids show the phenotype “long wings”. The hybrids in F1 receive an allele responsible for long wing from one pure line parent having long wings and another allele responsible for short wing from the other pure line parent having short wings. So, in these hybrids the allele responsible for short wings is masked and not expressed phenotypically in the presence of the allele responsible for long wings. This means that the allele for long wings is dominant over the allele for short wings.	1																	
2	Let “L” be the symbol of the dominant allele that determines the “long wings”. Let “s” be the symbol of the recessive allele that determines the “short wings”.	0.5																	
3	The Genotype of : Male parent: LL Female Parent: ss F1 descendants: Ls	1.5																	
4	<p><b>Factorial Analysis</b></p> <p>Parental phenotypes: parental genotypes: <math>\gamma P :</math></p> <p style="text-align: center;"> <math>\begin{array}{ccc} \text{♂} &amp; &amp; \text{♀} \\ \text{Long wings} &amp; \times &amp; \text{Short wings} \\ \text{LL} &amp; &amp; \text{ss} \\ 100\% \text{ (L)} &amp; &amp; 100\% \text{ (s)} \end{array}</math> </p> <p style="text-align: center;">Fertilization</p> <p>First filial generation, F1: Genotype: 100% Ls Phenotype: 100% long wings</p> <p>F1 genotypes: <math>\gamma F1 :</math></p> <p style="text-align: center;"> <math>\begin{array}{cccc} 50\% \text{ (L)} &amp; 50\% \text{ (s)} &amp; 50\% \text{ (L)} &amp; 50\% \text{ (s)} \\ &amp; &amp; \text{Fertilization} &amp; \end{array}</math> </p> <p>Second filial generation, F2: Table of cross (punnet square) :</p> <table border="1" style="display: inline-table; margin-right: 20px;"> <tr> <td style="text-align: center;">♂ \ ♀</td> <td style="text-align: center;">50%L</td> <td style="text-align: center;">50%s</td> </tr> <tr> <td style="text-align: center;">50%L</td> <td style="text-align: center;">25% LL</td> <td style="text-align: center;">25% Ls</td> </tr> <tr> <td style="text-align: center;">50%s</td> <td style="text-align: center;">25% Ls</td> <td style="text-align: center;">25% ss</td> </tr> </table> <table border="1" style="display: inline-table;"> <thead> <tr> <th style="text-align: center;">Genotypes</th> <th style="text-align: center;">Phenotypes</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">25% LL</td> <td style="text-align: center;">75% Long wings</td> </tr> <tr> <td style="text-align: center;">50% Ls</td> <td></td> </tr> <tr> <td style="text-align: center;">25% ss</td> <td style="text-align: center;">25% Short wings</td> </tr> </tbody> </table> <p>Therefore, the results are verified</p>	♂ \ ♀	50%L	50%s	50%L	25% LL	25% Ls	50%s	25% Ls	25% ss	Genotypes	Phenotypes	25% LL	75% Long wings	50% Ls		25% ss	25% Short wings	2
♂ \ ♀	50%L	50%s																	
50%L	25% LL	25% Ls																	
50%s	25% Ls	25% ss																	
Genotypes	Phenotypes																		
25% LL	75% Long wings																		
50% Ls																			
25% ss	25% Short wings																		

Part	Exercise 2 (5 points)	Mark
1	<p><b>Phase A</b> corresponds to auricular systole, since the volume blood increases in the ventricles from 20mL to 90 mL due to the contraction of the auricles which push the blood from the auricle into the ventricles.</p> <p><b>Phase B</b> corresponds to ventricular systole, since the volume blood decreases in the ventricles from 90ml to 20ml due to the contraction of the ventricles, which push the blood out the ventricles into the aorta and pulmonary artery through the opened sigmoid valves; meanwhile the tricuspid and bicuspid valves are closed.</p>	<p>1</p> <p>1</p>
2.1	<p>The systemic circulation</p> <p>The pulmonary circulation</p>	<p>0.25</p> <p>0.25</p>
2.2	<p>The systemic circulation supplies the body organs with oxygen gas and nutrients.</p> <p>The pulmonary circulation allows the enrichment of blood with oxygen gas and eliminates carbon dioxide gas from the blood at the level of the lungs.</p>	<p>0.25</p> <p>0.25</p>
3.1	<p>In case the myocardium is weak, the contraction of the ventricles (ventricular systole) becomes weak, so less quantity of blood is propelled from the ventricles into the arteries, so the blood circulation is slowed down.</p>	<p>1</p>
3.2	<p>The systemic circulation slows down, so the body cells will receive less amount of oxygen gas and nutrients. Therefore, this would lead to the death of tissue cells and finally death.</p>	<p>1</p>

Part	Exercise 3 (5 points)	Mark
1	Mouth ⇨ Esophagus ⇨ Stomach ⇨ Small intestine ⇨ Large intestine ↑ Blood                      ↑ Blood	1
2	<p style="text-align: center;"><b>Title: The variation of urine Flow (mL/min) as a function of time</b></p>	1.5
3	<p>One hour before the ingestion of 600 mL of water, the urine flow is 0 mL/min while the volume of plasma is 14 L. After 1.5 hours of the ingestion of water, the volume of plasma increases to max of 14.5 L while the volume of urine increases slightly to 2 mL/min during the same duration. Beyond 1.5 hours, the volume of plasma decreases to 14.2 L at the 2<sup>nd</sup> hour while that of urine increases to a max of 8 mL/min at the same time. After 3 hours, the volume of plasma decreases back to 14 L, initial value, and that of urine flow decreases to 2 mL/min. This means that the increase in the volume plasma following the ingestion of water is regulated by the elimination of excess water from the body by the kidneys during the formation of urine. Consequently, the kidney plays the role of regulator.</p>	1.5
4	Drink lot of water to compensate the loss of water by defecation.	1

Part	Exercise 4 (5 points)	Mark
1	Functional food: Carrots – green salad Energy food: Potatoes- flan Building food: Steak	0.75
2	The energy provided by the lunch is : $\frac{40 \times 10000}{100} = 4000 \text{ kJ}$	0.5
3	The total energy provided by: Anna's lunch meal = $100 + 48 + 750 + 4000 + 380 = 5278 \text{ KJ}$ Alia's lunch meal = $160 + 97 + 830 + 2500 + 380 = 3967 \text{ KJ}$	1

<b>4.1</b>	<p>The lunch meal must provide each of girls with 4000 kJ in order to cover the daily energy needs.</p> <p>The total energy supplied by Anna's lunch is 5278 kJ which is much greater than the proper required energy (4000kJ), with an excess value of 1278 KJ (5278 - 4000). Therefore, this menu is not adapted to Anna's needs.</p> <p>On the other hand, the total energy supplied by Alia's lunch is 3967 kJ, which is very close to the proper required energy (4000 kJ). This means that Alia's meal is adapted to the required energy need.</p>	<b>1</b>
<b>4.2</b>	<p>A diet is said to be balanced if it is composed of diversity of foods and if it covers the proper energy needs of the individual. This should be accompanied with the consumption of reasonable quantity of proteins, lipids, carbohydrates, mineral salts and vitamins. The meal of Anna is diversified: it contains the 3 groups of food: functional, energy and builders but its energy value is very high. Then one of the conditions is missing and consequently the meal is unbalanced.</p>	<b>1</b>
<b>5</b>	<p>Reduce the portion of fried potatoes (fries) that is consumed and increase the portion of vegetables.</p>	<b>0.75</b>