

الاسم : مسابقة في علوم الحياة والارض  
الرقم : المدة : ساعة واحدة

*Answer the following questions.*

**Question I (4 points)**

Indicate the right statement(s) and correct the false one(s).

- a- Our cells use nutrients to liberate energy and produce new molecules.
- b- At the end of mitosis, the produced four daughter cells carry the same genetic program.
- c- Air pollution increases the risk of respiratory diseases.
- d- The genes are located only on the sex chromosomes.

**Question II (4 points)**

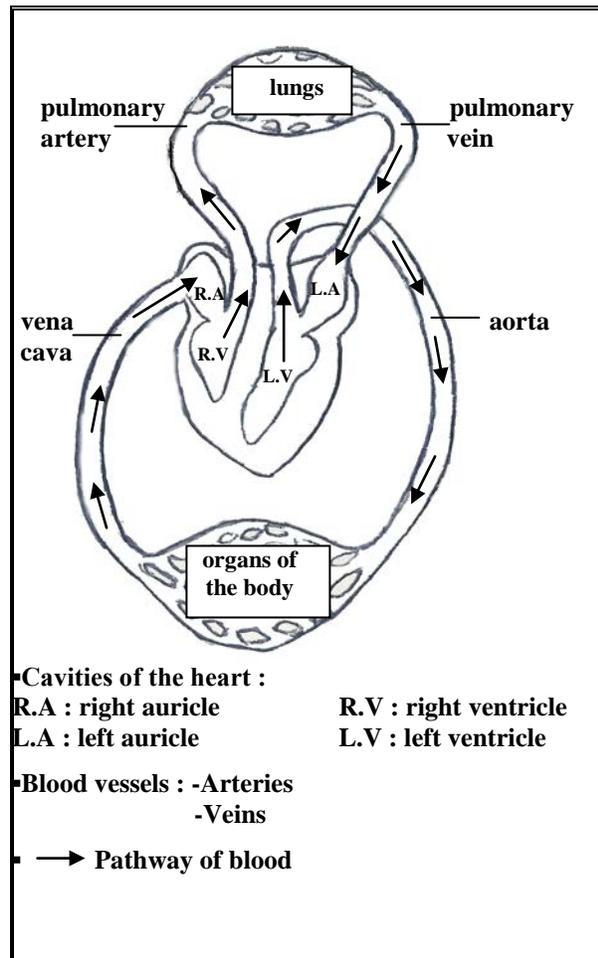
The adjacent document shows "The double circulation" of blood :

- the pulmonary circulation or the small circulation
- the systemic circulation or the big circulation.

a- By referring to the document, name :

- 1- the cavities of the heart
- 2- the blood vessels that carry blood away from the heart
- 3- the blood vessels that carry blood into the heart.

b- Specify the importance of each of the two circulations concerning the exchange of gases.



**Question III (5½ points)**

The synthesis of hemoglobin is due to a gene localized on an autosomal chromosome. The gene is present in the cell of an individual in two alleles; one allele is of a paternal origin and the other of a maternal origin. The two alleles are :

- allele **N** that determines the synthesis of normal hemoglobin
- allele **n** that determines the synthesis of abnormal hemoglobin.

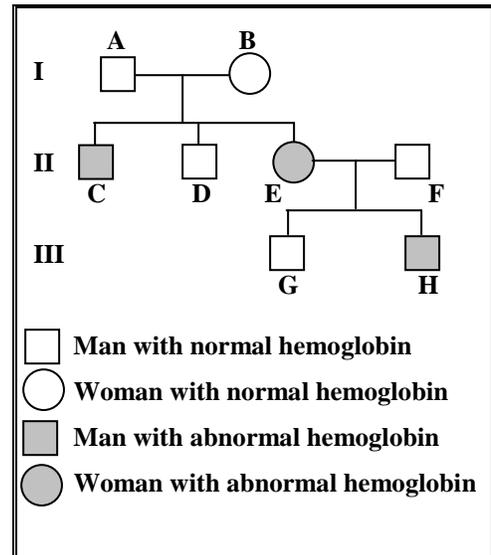
A person has normal hemoglobin if he has two alleles **N** and **N** or one allele **N** and one allele **n**; however a person with abnormal hemoglobin has two alleles **n** and **n**.

The pedigree in the adjacent document shows the appearance of the abnormal hemoglobin in a family.

- a-** Pick up, from the text, the allele that determines the synthesis of each of the two hemoglobins.
- b-** By referring to the text and the pedigree, indicate the two alleles present in the cells of :
  - father **A**
  - mother **B**
  - daughter **E**.

Justify the answer.

- c-** Make a factorial analysis to verify the phenotypic and genotypic proportions of the children of couple **E** and **F**.

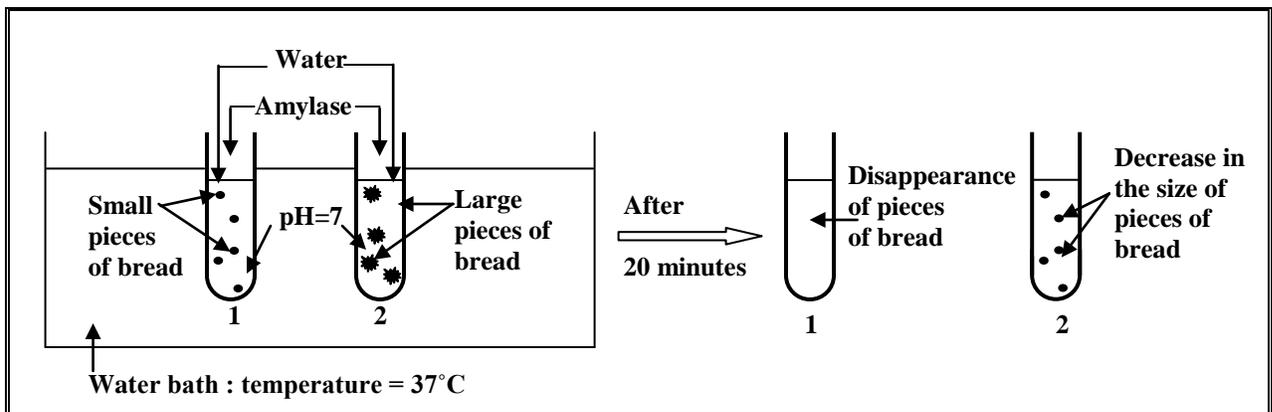


**Question IV (6½ points)**

The mechanical digestion permits the decomposition of food into small pieces that facilitates the chemical action of enzymes.

To verify this hypothesis, bread pieces of different sizes were placed in two test tubes in the presence of the enzyme: salivary amylase

The conditions and the results of the experiment are figured in the document below.



- a-** Represent, in the same table , the conditions of the experiment and the results obtained.
- b-** Pick up, from the text, the tested hypothesis.

**c-** Interpret the obtained results and draw out a conclusion

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مسابقة في علوم الحياة والارض**Question I (4 points)**

- a-** True. (1 pt.)  
**b-** False. (1 pt.)  
 At the end of mitosis, the produced two daughter cells carry the same genetic program.  
**c-** True. (1 pt.)  
**d-** False. (1 pt.)  
 The genes are located on all the chromosomes.  
 or  
 Some genes are located on the sex chromosomes. (1 pt.)

**Question II (4 points)**

- a.1-** The cavities of the heart are: right auricle, left auricle, right ventricle and left ventricle. (1 pt.)  
 2- Aorta and pulmonary artery. (1/2 pt.)  
 3- Pulmonary vein and vena cava. (1/2 pt.)
- b-** The pulmonary circulation enriches the blood with oxygen and gets rid of carbon dioxide. (1 pt.)  
 The systemic circulation supplies the organs with oxygen gas and carries away the carbon dioxide. (1 pt.)

**Question III (5½ points)**

- a-** Allele **N** determines the synthesis of the normal hemoglobin. (1/2 pt.)  
 Allele **n** determines the synthesis of the abnormal hemoglobin. (1/2 pt.)
- b-** The two alleles of:  
 - father **A: N and n**  
 - mother **B: N and n**  
 - daughter **E: n and n**. (3/4 pt.)

**Justification:**

Daughter **E** has two alleles **n** and **n** since she has abnormal hemoglobin. (1/4 pt.)

Father **A** and mother **B**, who have normal hemoglobin, possess the allele **N**. Also, they possess the allele **n** since their daughter **E** possesses the two alleles **n** and **n**, one of paternal origin (**A**) and the other of maternal origin(**B**). (½ pt.)

c- P : ♀ **nn** × ♂ **Nn** (½ pt.)  
 ♂P :  $\begin{matrix} \textcircled{n} \\ + \\ 1 \end{matrix}$   $\begin{matrix} \textcircled{N} \\ \nearrow \\ \frac{1}{2} \end{matrix}$   $\begin{matrix} \textcircled{n} \\ \searrow \\ \frac{1}{2} \end{matrix}$  (1 pt.)

Table of cross:

	♂	<b>N</b> ½	<b>n</b> ½
♀	<b>n</b> 1	<b>Nn</b> ½	<b>nn</b> ½

Results:

-2 genotypes: **Nn** ½ (½ pt.)  
**nn** ½ (½ pt.)  
 -2 phenotypes: [**N**] ½ (½ pt.)  
 [**n**] ½ (½ pt.)

**Question IV (6½ points)**

a-

Tube	Conditions						Results
	Water	Enzyme	Bread	pH	Temperature(°C)	Duration (min)	
1	+	Amylase	Small pieces	7	37	20	Disappearance of pieces of bread
2	+	Amylase	Large pieces	7	37	20	Decrease in the size of pieces of bread

(+) presence

**Title:** Table showing the conditions and the results of the experiment. (3 pts.)

b- Hypothesis: The mechanical digestion which permits the decomposition of food into small pieces facilitates the chemical action of enzymes. (1 pt.)

c- After 20 minutes, and under the same conditions, the small pieces of bread in tube 1 disappear while, the large pieces of bread in tube 2 decrease in size.

This shows that in the presence of amylase, bread is totally digested in tube 1 while, it is partially digested in tube 2. (2 pts.)

Hence, the mechanical digestion facilitates the action of the enzyme. (½ pt.)