

الاسم:  
الرقم:مسابقة في مادة علوم الحياة والأرض  
المدة: ساعة واحدة

**Answer the following questions.**

**Question I (3 points)**

Indicate the correct expressions and correct the false one(s).

- 1- The contraction of the esophagus permits the progression of food towards the stomach.
- 2- Bile facilitates the digestion of proteins by emulsifying it.
- 3- The sigmoid valves prevent the back flow of blood into the ventricles.
- 4- During diastole, the myocardium contracts.

**Question II (5 points)**

The adjacent document represents some phases of a cellular division. For simplicity, we represent only the chromosome pair 9 where alleles (**B** and **O**) of the gene determining blood group in humans are localized.

1-By referring to the given document :

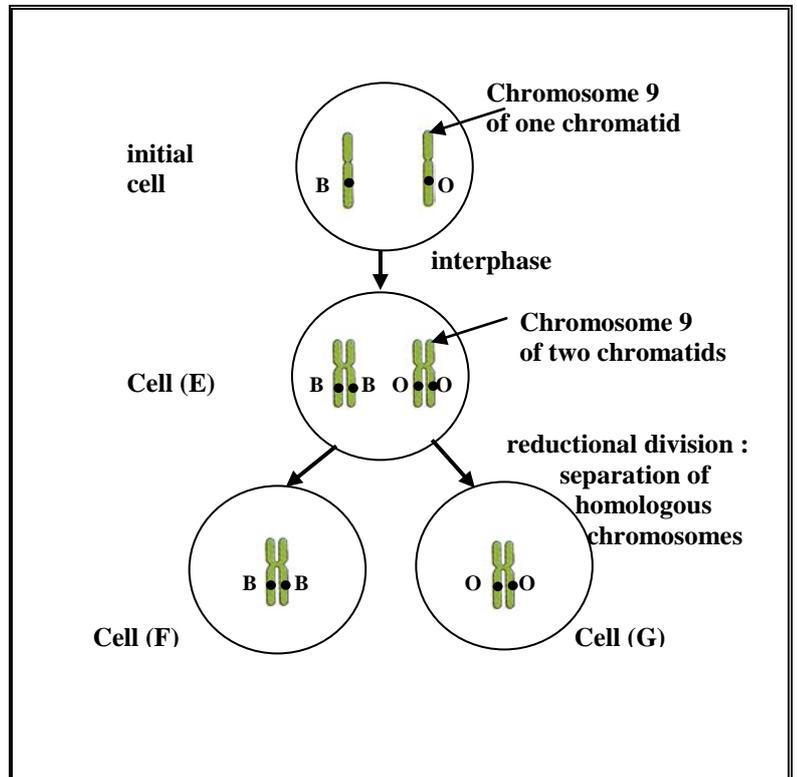
- a- Describe the modification that occurs on chromosome number 9 as the **initial cell** transforms to **cell (E)**.
- b- Compare the number of chromosomes in cells (**E**), (**F**) and (**G**).
- c- Pick out the cause of the difference in the number of chromosomes in these cells (**E**, **F** and **G**).

2- a- Precise the number of cells

produced by cells (**F**) and (**G**) after the second meiotic division.

b- Do the cells obtained at the end of meiosis carry the same genetic information?

Justify the answer by referring to the document and to the acquired knowledge .



**Question III (6 points)**

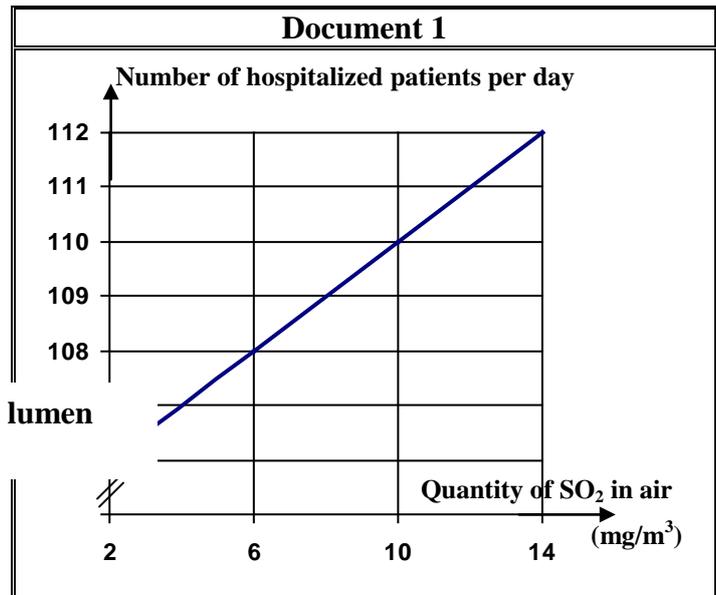
Cystic fibrosis is a severe genetic disease characterized by digestive and respiratory troubles. It is due to a gene localized on chromosome 7. This gene exists in multiple alleles. If each chromosome of the pair 7 carries the allele **m** responsible for the disease, the individual will be affected. If one of the two chromosomes 7 carries the normal allele **N** and the other chromosome carries allele **m**, the individual won't be affected.

- 1- Pick out from the text :
  - a- the characteristics of cystic fibrosis.
  - b- the cause of such a disease.
- 2- Is the allele responsible for cystic fibrosis dominant or recessive? Justify the answer .
- 3- A normal homozygous woman married a normal heterozygous man.
  - a- Write the genotype of this woman and that of her husband.
  - b- Do the necessary factorial analysis to determine whether this couple is in risk of having a sick child.

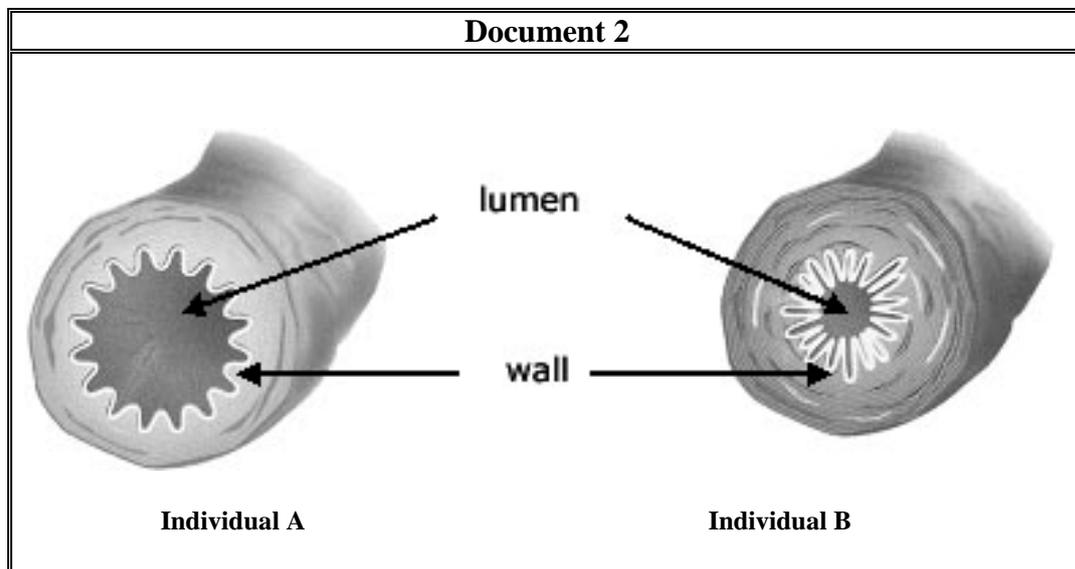
**Question IV (6 points)**

In a region polluted by sulfur dioxide gas ( $\text{SO}_2$ ), we noticed that the number of hospitalized patients for respiratory difficulties varies with the content of  $\text{SO}_2$  in air (**document 1**).

- 1- Represent, in the form of a table, the variation of the number of hospitalized patients in function of the quantity of sulfur dioxide gas in air.
- 2- Analyze the graph of **document 1**.  
What do you conclude?



**Document 2** shows the aspect of the bronchi of a healthy individual **A** and of another individual **B** who lives in this region polluted by  $\text{SO}_2$ .



- 3- Compare the aspect of the bronchi of these two individuals (**document 2**).  
Derive the effect of sulfur dioxide on the bronchi and its consequence on respiration.

اسس التصحيح  
مسابقة في علوم الحياة والارض**Question I (3 points)**

- 1- True. (0.5 pt)
- 2- False. (1 pt)  
Bile facilitates the digestion of lipids by emulsifying it.
- 3- True. (0.5 pt)
- 4- False. (1 pt)  
During diastole, the myocardium relaxes.  
or  
During systole the myocardium contracts.

**Question II (5 points)**

- 1- a- The initial cell contains a pair of chromosome 9, each is single chromatid. One chromosome carries allele B and the other chromosome carries allele O. After interphase, this cell becomes cell (E) containing 2 chromosomes No. 9, each of two chromatids carrying the same type of allele. (1.5 pt)
- b- Cell (E) contains 2 chromosomes 9, where as each of the two cells (F) and (G) contains one chromosome 9 which is half the number of chromosomes in cell E. (1 pt)
- c- The cause of such a difference is reductional division or separation of homologous chromosomes. (0.5 pt)
- 2- a- Four cells. (0.5 pt)
- b- No, (0.5 pt)  
because the 2 cells produced by cell (F) carry allele B, where as the 2 cells produced by cell (G) carry allele O. Allele B carries genetic information which is different from the genetic information carried by allele O. (1 pt)

**Question III (6 points)**

- 1- a- The characteristics of cystic fibrosis are digestive and respiratory troubles. (1 pt)
- b- The cause of this disease is a gene localized on chromosome 7  
Or  
is due to the presence of allele m on each of the chromosome pair 7. (1 pt)

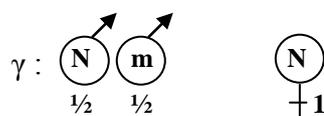
2- It is recessive, (0.5 pt)  
 because for an individual to be affected it is necessary that each of the chromosomes pair 7 carries the allele **m**.

Or

Non affected individuals can have one chromosome 7 carrying the normal allele **N** and the other chromosome carrying allele **m** responsible for the disease, in this case, the dominant normal allele **N** masks the recessive allele **m**. (1 pt)

3- a- Genotype of the woman : **NN** (0.25 pt)  
 Genotype of the husband : **Nm**. (0.25 pt)

b- Genotypes of parents : ♂ **Nm** × ♀ **NN** (0.25 pt)



(0.75 pt)

Table of cross :

	♂		
		N 1/2	m 1/2
♀			
N 1		NN 1/2	Nm 1/2

(0.5 pt)

According to the table, all children would be healthy. Thus, this couple is not in risk of having an affected child. (0.5 pt)

**Question IV (6 points)**

1-

Quantity of SO <sub>2</sub> in air (mg/m <sup>3</sup> )	2	6	10	14
Number of hospitalized patients per day	106	108	110	112

**Title :** Table showing the variation of the number of hospitalized patients in function of the quantity of SO<sub>2</sub> in air. (1.5 pt)

2- The number of hospitalized patients is 106 patients/day when the quantity of SO<sub>2</sub> in air is 2mg/m<sup>3</sup>. This number increases progressively with the increase in the quantity of SO<sub>2</sub> and reaches 112 patients/day when the quantity of SO<sub>2</sub> reaches 14mg/m<sup>3</sup>. (1.5 pt)

This indicates that the number of hospitalized patients is proportional to the quantity of SO<sub>2</sub> in air. Therefore, sulfur dioxide is a polluting substance in air that favors respiratory difficulties. (1 pt)

3- The lumen of the bronchus of individual **B** is smaller than the lumen of the bronchus of the healthy individual **A**. While, the wall of the bronchus of individual **B** is thicker than the wall of the bronchus of individual **A**. (1 pt)

This shows that sulfur dioxide narrows the bronchi which in turn, renders the circulation of air in the bronchi difficult leading to respiratory problems. (1 pt)