

### Exercise 1 (7points)

### Multiple Sclerosis, a Neurological Disease

Multiple sclerosis is a neurological disease that begins with visual troubles, partial paralysis, clumsiness, or walking problems. This disease is due to a progressive destruction of the myelin sheath by white blood cells.

#### Document 1

- 1- Pick out from document 1:  
1-1- the symptoms of multiple sclerosis.  
1-2- the cause of this disease.

The aspect of a myelinated neuron of an affected individual shows that the myelin sheath is partially destructed during the early phase (beginning of the disease) whereas this sheath becomes completely destructed at the late phase.

#### Document 2

- 2- Compare the aspect of the myelin sheath during the two phases mentioned in document 2.

Document 3 represents the speed of conduction of the nervous message recorded at the level of a myelinated nerve fiber during the two phases mentioned in document 2, as well as in a healthy individual.

	Healthy individual (Control)	Affected individual (Early phase)	Affected individual (Late phase)
Speed of conduction of nerve message (in m/s)	100	70	10

#### Document 3

- 3- Analyze the obtained results.  
4- What can you conclude?  
5- Name two other neurological diseases.

### Exercise 2 (6 points)

### Obesity

Obesity, a state characterized by an abnormal or excessive accumulation of body fat, can lead to dangerous consequences on health. Two individuals A and B consult a dietitian. These persons are of the same age (30 years) and have the same height (1.7m), but they differ in their body masses: A = 70 kg, B = 90 kg.

The body mass index (BMI) is used to measure the degree of obesity :  
 Individual having BMI between 20 and 25 belongs to the normal category.  
 Individual having BMI between 25 and 30 belongs to the overweight category.  
 Individual having BMI greater than 30 belongs to the obese category.

**Document 1**

1- Calculate the BMI of each individual using the following formula:

$$\text{BMI} = \frac{\text{mass (kg)}}{(\text{Height m})^2}$$

2- Identify, by referring to document 1, the category to which each individual belongs.

Document 2 reveals the life style of each of the individuals A and B.

	<b>Individual A</b>	<b>Individual B</b>
<b>Life style</b>	Moderate activity	Sedentary (no activity)

3- Compare the life styles of these two individuals.

		<b>Individual A</b>	<b>Individual B</b>
<b>Food ration (g)</b>	Carbohydrates	117	117
	Proteins	27	27
	Lipids	31.5	64

**Document 3**

4- Compare the food ration in the two individuals.

5- Draw out the cause of the excess of the body mass in the concerned individuals.

6- Name two diseases that obese people might suffer from.

**Exercise 3 (7 points)****An Application of Biotechnology**

Referring to certain genetic manipulations, researchers could transform plants into factories producing useful substances for humans.

For instance, genetically modified cells of tobacco plants become able to produce a protein whose absence in humans provokes a severe disease: cystic fibrosis. Document 1 shows some steps of the used technique.

1. Extraction of gene E coding for the synthesis of the considered protein
2. Insertion of gene E in the plasmid of the bacterium
- 3- Infection of the tobacco cell by the bacterium
4. Integration of the gene E in the chromosome of the tobacco cell
- 5- Production of the protein by the cell

**Document 1**

- 1- Name the enzyme used in step 1 and that used in step 2.
- 2- Draw out the role of the bacterium.
- 3- Name the technique schematized in the document. Justify the answer.
- 4- State two other applications of this technique, one in the agricultural field and another one in the medical field.