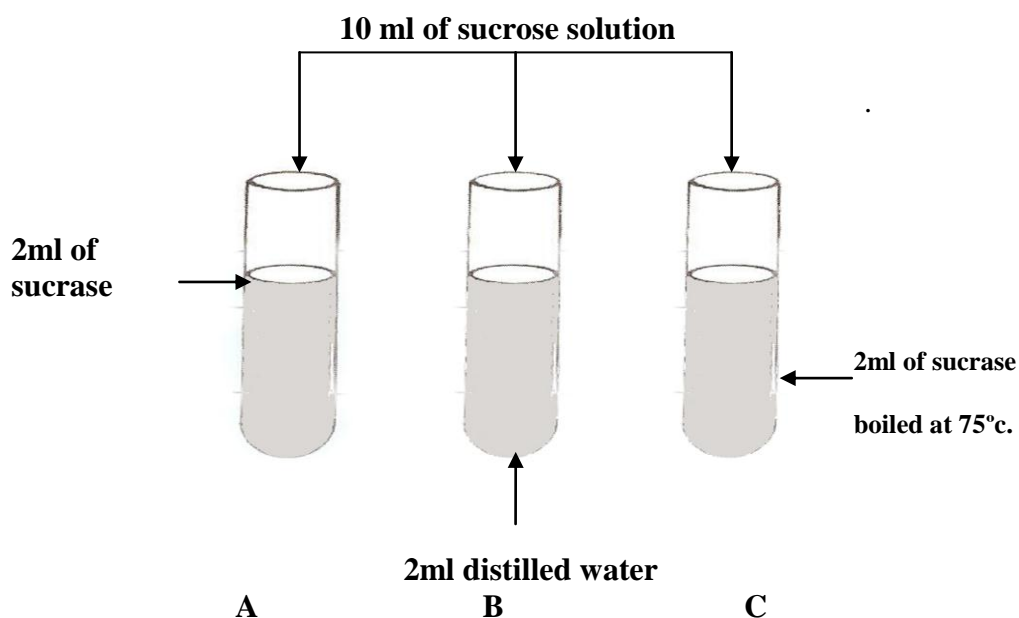


**First Exercise (8.5 points)**

The sucrase is a digestive enzyme that acts on sucrose and transforms it into glucose. The glucose is then transported by the blood to cells.

The document below presents the conditions of the in vitro digestion of saccharose.



The 3 tubes **A**, **B**, and **C** are made **basic** and are placed in a bath at **37°C**.

**Thirty minutes later the sucrose disappears in tube A and stays the same in the 2 tubes B and C.**

- 1) Construct a table that includes the different conditions of the experiment.
- 2) Pick up the manipulated variable :
  - a) in the tubes **A** and **B**.
  - b) in the tubes **A** and **C**
- 3) Explain the role of tube **B** in the experiment.
- 4) Interpret the results of this experiment, then deduce the property of enzyme involved in this case.
- 5) A chemical reaction takes place inside the cell between glucose and oxygen :
  - a) Write the word equation of this reaction.
  - b) Indicate the oxydant agent in this reaction.
  - c) Draw a functional diagram (schema) showing this reaction and the usages of the energy produced.

**Second Exercise (7.5 points)**

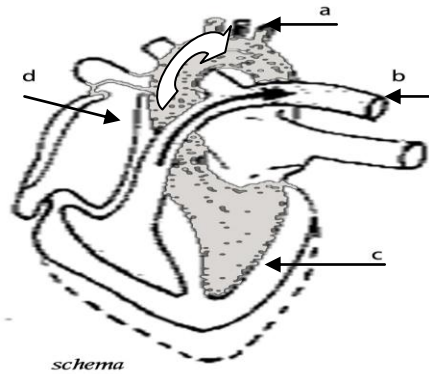
**A)** The heart is the main organ of the circulatory system. It is supplied with blood by the coronary arteries. If one of the arteries is clogged, the area of the heart that is normally supplied with blood from this artery would be deprived of nutrients and oxygen gas. This area stops contracting and eventually dies.

A reaserch on the relation between the level of cholesterol and the death rate of cardiovascular diseases was conducted and the studies reveal the following results:

Level of cholesterol in the blood in (g/l)	0.8	2	2.2	2.5	2.6	2.8
Rate of death by cardiovascular diseases for 1000 persons	4	5	6	8	12	16

- 1) Formulate the hypothesis to be tested by this research.
- 2) Analyse the information of the above table in order to verify the validity of your hypothesis.
- 3) Refer to your acquired knowledge to give the name of the disease that results from the accumulation of fat in the coronary arteries.

**B)** The figure below illustrates a phase of the cardiac activity.



- 4) Label the figure and specify the main function of (a).
- 5) Name and describe this phase of the cardiac activity.

### Third Exercise (4 points)

To prepare a karyotype, the chromosomes are arranged in the decreasing order of their size and grouped by pairs of homologous chromosomes where each pair is made of a maternal chromosome and a paternal chromosome.

The document below presents the chromosomal material of a grasshopper.



- 1) The above document presents a karyotype. Justify your answer by referring to the text only.
- 2) Using letters, construct the karyotype of this grasshopper.
- 3) Specify the number of chromosomes of this document.
- 4) The grasshopper presents an abnormality. Justify this affirmation.
- 5) Identify the sex chromosomes. Is it a male or a female grasshopper? Justify your answer.

Question	Suggested answer						grade	Remarks	
I 8.5pts	1	tube	substrate	Temp.	medium	enzyme	temps	2	-0.5 if no title 0 if any missing information other logic table
		A	sucrose	37°	Basic	Sucrase	30min		
		B	sucrose	37°	Basic	None	30min		
		C	sucrose	37°	basic	Boiled	30min		
	2	Tubes A and B: presence of sucrase Tubes A and C: temperature of the enzyme						1	
	3	The tube B is a control tube it is used to verify the effect of sucrase on the digestion of sucrose						1	
	4	In tube A where sucrase was present the sucrose disappeared then it was digested. In tube B where sucrase was absent the sucrose stayed constant then it was not digested and in tube C were boiled sucrase was present the sucrose did not disappear then it was not digested Deduction: the sucrase acts on sucrose at 37°C.						2  0.5	
5	a- glucose + oxygen gas → carbon dioxide + water + energy						1		
	b - oxygen						0.5		
6	Diagram						1.5	0.5 usages of energy	
II 7.5pts	1	The cholesterol has an effect on the rate death by cardiovascular diseases.						1	
	2	When the level of cholesterol in the blood was 0.8 g/l the rate death was 4persons/1000 and as the level of cholesterol in the blood increases from 0.8g/l to 2.8g/l the death rate increases from 4 to16 persons/1000. Then the increase in the level of cholesterol increases the death rate by cardiovascular diseases.						1  0.5	
	3	Infarctus						0.5	
	4	a- label function of a						2 0.5	
	5	Ventricular systole						0.5	
		Description of ventricular systole						1.5	
III 4pts	1	Non since the chromosomes are not yet grouped in homologous pairs and arranged in order of their size						1	
	2	e-h c-i-g f-b a-d						1	
	3	9 chromosomes						0.5	
	4	Trisomy of the third pair of chromosomes						0.5	
	5	a and d are the sex chromosomes. The grasshopper is a male since these chromosomes are not homologous						1	