

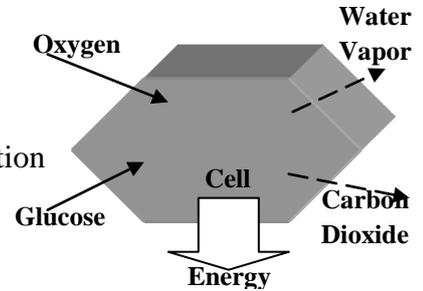
**First Exercise (3.25 points)**

The cellular metabolism includes all chemical reactions occurring in the body, that of synthesis and degradation.

During a synthesis reaction, the cell uses nutrients to produce new materials that assure growth, cellular renewal and storage (for example in the form of lipids).

The nutrients used derive from food intake. But a diet rich in lipids causes cardiovascular diseases which are usually lethal.

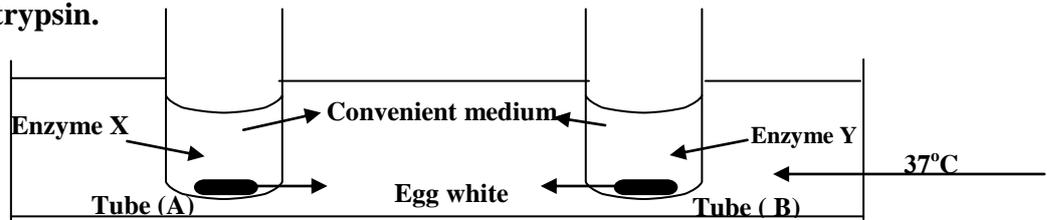
The adjacent figure shows one reaction of cellular metabolism.



- 1- a- Write the word equation of the reaction shown in the figure.  
b- Pick up from the text a word that designates this reaction.
- 2- Based on the acquired knowledge, give another name for the synthesis reaction mentioned in the text.
- 3- Explain the relation between synthesis reactions and cardiovascular diseases.

**Second Exercise (4.5 points)**

In order to distinguish between the action of two protease (pepsin and trypsin) on the simplification of proteins (egg white), the following experiment is performed using two enzymes X and Y where one is pepsin and the other is trypsin.

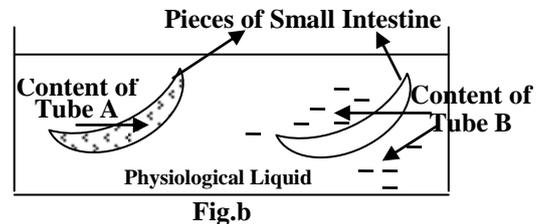
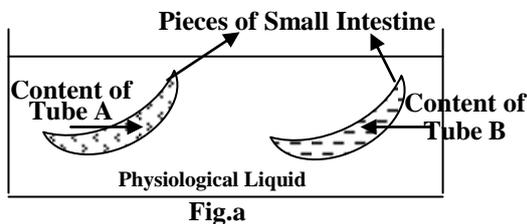


The following table shows the results of Biuret test done in both tubes A and B after one hour.

Tube	A	B
Biuret Test	Positive Result	Negative Result

- 1- Pose the problem studied in this experiment.
- 2- Analyze the above experiment.
- 3- Identify each of enzymes X and Y. Justify the answer basing on the analysis.

We pour the product obtained in each tube after one hour in two pieces of small intestine taken from a man. Then we replace these two pieces in a container containing physiological liquid (fig.a). After a while we noticed a diffusion of the content of tube B only from the intestine to the liquid (fig.b)



- 4- Give the name of the phenomenon that leads to the diffusion of tube B content.
- 5- Indicate the characteristic of the intestinal wall shown in this experiment.

### Third Exercise (5.25 points)

Mucoviscidosis is a disease characterized by an abundant secretion of heavy mucus that obstructs the bronchus and the digestive tube. The gene responsible for this disease is carried by chromosome 7.

A boy having mucoviscidosis is born from two normal parents. This boy has two brothers and a sister who are normal, and a brother who is affected.

This boy marries a normal woman and they have six children, among them two boys are affected by mucoviscidosis.

1- Reconstitute the pedigree of this family starting from the parents of the boy and using the following legend.



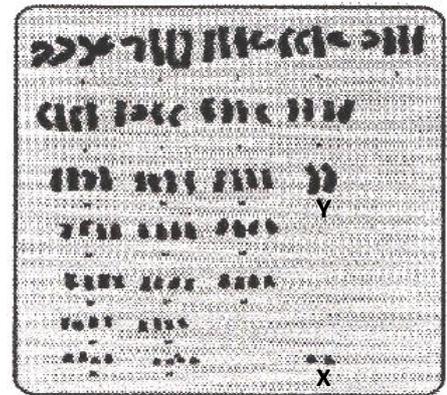
- 2- "The mucoviscidosis is an autosomal disease." Justify this statement.
- 3- Indicate if the allele responsible for this disease is recessive or dominant. Justify the answer.
- 4- Designate by symbols the corresponding two alleles.
- 5- Specify the genotype of the boy's wife.

### Fourth Exercise (7 points)

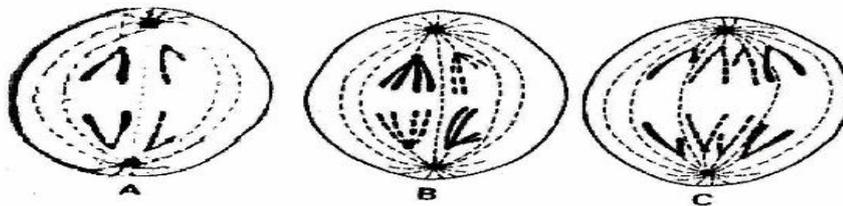
A haploid cell is a cell having "n" chromosomes, which means that each type of chromosome is represented by one example. Whereas a diploid cell is a cell having "2n" chromosomes, which means that, each type of chromosome is represented by two examples.

The adjacent document represents the karyotype of a human embryo having a chromosomal anomaly: "the tetraploidism".

- 1- Determine the sex of this embryo.
- 2- Knowing that the chromosomal formula of a normal girl is 44 + XX and that of a normal boy is 44 + XY, write the chromosomal formula of the embryo having the tetraploidism.
- 3- Justify the term "tetraploidism" attributed to this anomaly.



A mother cell, having 4 chromosomes, undergoes mitosis followed by meiosis. The figures below represent this cell during anaphase of the two divisions involved.



- 4- Indicate (exactly) to which cellular division each of the above figures corresponds. Justify the answer.
- 5- Deduce the cause of the anomaly represented by the embryo's karyotype (tetraploidism), knowing that it is related to the formation of the parents gametes (ovules and spermatozoa).