وزارة التربية والتعليم العالي **المديرية العامة للتربية** **دائرة الامتحانات**	**الشهادة المتوسطة**	**الدورة العادية للعام 2011**
	مسابقة في مادة علوم الحياة والأرض المدة ساعة	**الاسم:** **الرقم:**

Answer the four following exercises:

First exercise (5 points)

Mitosis and Meiosis

Indicate the true expressions and correct the false ones.

1- The two chromatids of a chromosome are hold together by the centrosome.
2- The mode of division that permits an equal distribution of the chromosomal material between the two daughter cells is meiosis.
3- The equatorial plate is formed during the second phase of mitosis.
4- A gamete possesses **n** chromosomes of two chromatids each.
5- Homologous chromosomes separate during anaphase of the first meiotic division.

Second exercise (5 points)

An abnormality in color vision

In human species, color vision is determined by several genes. One of these genes, which is localized on the sex chromosome **X**, has two alleles :

▪ a dominant allele **N** determining normal color vision.
▪ a recessive allele **d** determining abnormal color vision or daltonism.

A man has 2 different sex chromosomes **X** and **Y** while a woman has 2 identical sex chromosomes **X** and **X**.

1- By referring to the text, pick out the statement that indicates :
- The meaning of 'daltonism'
- The cause of 'daltonism'.

2- Detemine the number of alleles of this gene that can exist in a:
a- man
b- woman.

The marriage of a man with normal vision and a woman heterozygous for normal vision gave three children : a boy and a girl with normal vision and a daltonian boy.

3- a- Construct the pedigree (genealogical tree) of this family.
b- Write the genotype of the :
- father
- mother
- daltonian boy .

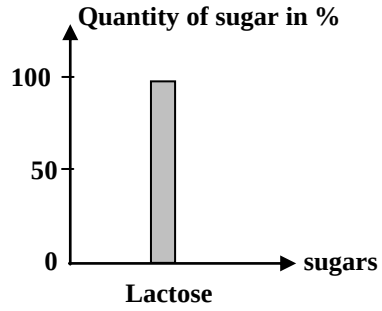
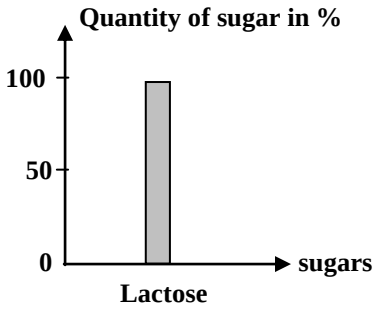
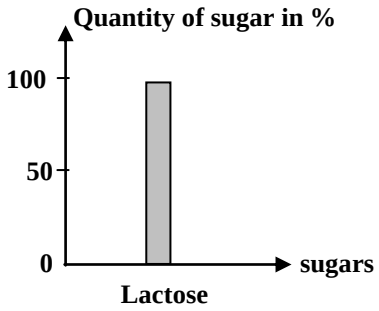
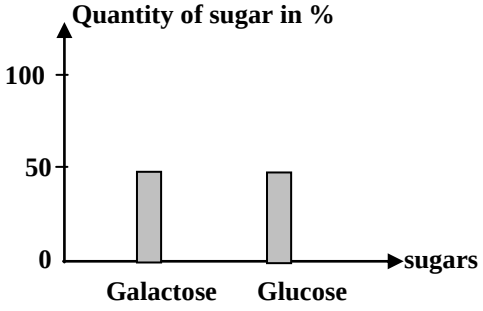
Third exercise (5 points)

Digestion of milk sugar

To realize an in vitro digestion of lactose, a milk sugar, we put 5ml of milk and 0.5 ml of NaOH (to render the medium basic) in each of the two tubes **A** and **B**. We add pancreatic lactase in tube **B** only. Then, we place the two tubes at temperature of 37 °C and for a convenient duration.

1- Pick out from the text, the common conditions for both tubes **A** and **B** in this experiment.

Moreover, we measure the quantity of sugars present in each of the two tubes at the beginning and the end of the experiment. The measured results are revealed in the **document** below.

Tube	Beginning of the experiment	End of the experiment
A		
B		

2- Analyze the obtained results. What do you conclude?

3- "Lactose is formed of two simple sugars".
Justify this statement based on the obtained result in tube **B**.

Fourth exercise (5 points)

Effect of smoking on the transport of oxygen gas

At the level of the pulmonary alveoli, hemoglobin (**Hb**) in red blood cells fixes oxygen gas ($\mathbf{O_2}$) forming an unstable product : oxyhemoglobin ($\mathbf{HbO_2}$).
In the presence of carbon monoxide (**CO**) in the alveoli, hemoglobin fixes (**CO)** forming a stable product (**HbCO**) .

N.B. CO : a harmful gas contained in the fume of tobacco.

Studies showed the effect of (**CO)** on the transport of $\mathbf{O_2}$ gas by hemoglobin.
The results of these studies are shown in the table below.

Rate of **CO** in the alveoli (in %)	0.5	1	1.5	2	2.5
Quantity of $\mathbf{HbO_2}$ in blood (in %)	90	80	70	60	50

1- Draw the curve showing the variation of the quantity of ($\mathbf{HbO_2}$**)** in blood in function of the rate of (**CO)** in the alveoli.

2- Analyze these results. Derive the effect of (**CO**) on the transport of oxygen gas by hemoglobin.

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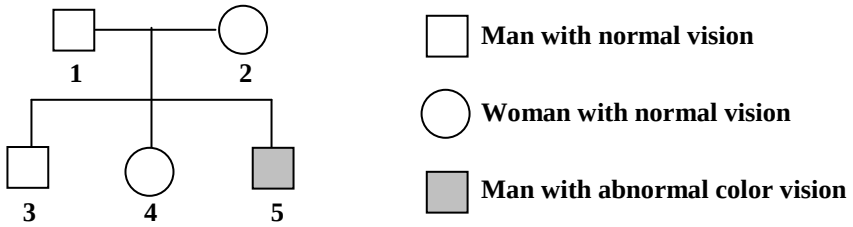
First exercise (5 points)

Part of the Q	Answer	Mark
1	The two chromatids of a chromosome are hold together by the centromere.	1
2	The mode of division that permits an equal distribution of the chromosomal material between the two daughter cells is mitosis.	1
3	True.	1
4	A gamete possesses **n** chromosomes of one chromatid each.	1
5	True.	1

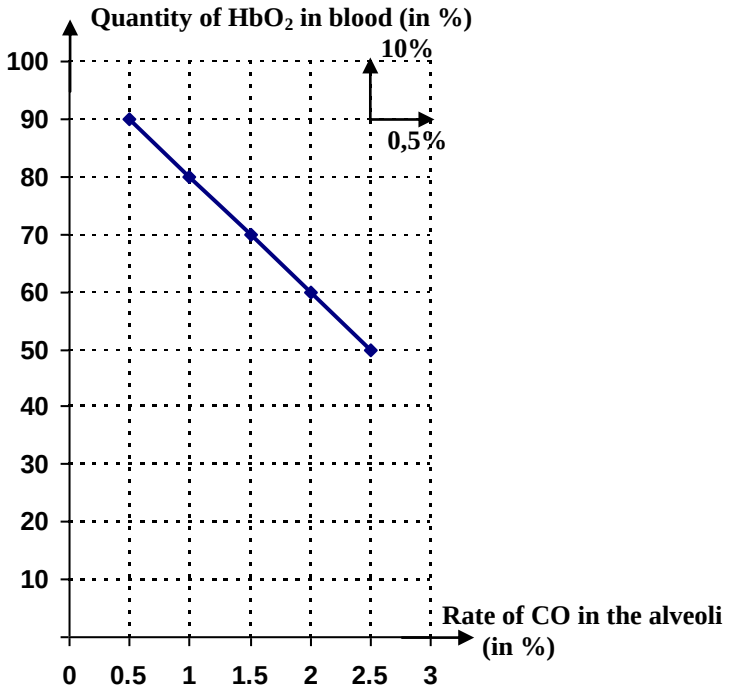
Second exercise (5 points)

Part of the Q	Answer	Mark
1-	- Daltonism means the abnormal color vision. - The cause of the color blindness is a recessive allele.	1
2-a	In a man, there is only one **X** chromosome, thus the number of alleles of this gene is **1**.	1
2-b	In women, there are two **X** chromosomes, thus the number of alleles of this gene is **2**.	1
3-a		1.25
3-b	Genotype : -of father with normal vision : $\mathbf{X^NY}$ -of mother heterozygous for normal vision : $\mathbf{X^NX^d}$ -of boy with abnormal color vision : $\mathbf{X^dY}$	0.75

Third exercise (5 points)

Part of the Q	Answer	Mark
1	The common conditions for the two tubes in this experiment are: 5 ml of milk, 0.5 ml of NaOH, temperature at 37 ° C and convenient duration.	1
2	The quantity of lactose is 100% in the two tubes A and B at the beginning of the experiment. At the end of the experiment, this quantity remains the same (100%) in tube A which does not contain pancreatic lactase, but in tube B, containing pancreatic lactase, we obtain 50% of galactose and 50% of glucose. This indicates that the lactose has been digested only in tube B and transformed into glucose and galactose. Thus, the digestion of lactose necessitates the presence of lactase.	3
3	We obtain 50% of galactose and 50% of glucose in tube B This indicates that these two sugars are constituents (of the 100%) of lactose at the beginning of the experiment. Thus, lactose is a sugar formed of galactose and glucose.	1

Fourth exercise (5 points)

Part of the Q	Answer	Grade
1	 Curve showing the variation of the quantity of **HbO_2** in blood in function of the rate of **CO** in the alveoli.	3
2	The quantity of **HbO_2** in blood is 90% when the rate of **CO** in the alveoli is 0,5%. This quantity of **HbO_2** decreases with the increase of the rate of **CO** in the alveoli and reaches 50% for a rate of **CO** of 2,5% in the alveoli. Therefore the carbon monoxide fixed by hemoglobin reduces the transport of oxygen gas by this hemoglobin.	2