المركز التربوي للبحوث والإنماء	الهيئة الأكاديميّة المشتركة قسم : العلوم	المادة: علوم الحياة والارض الشهادة: المتوسطة نموذج رقم -٢- المدّة : ساعة واحدة

نموذج مسابقة (يراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي 2016-2017 وحتى صدور المناهج المطوّرة)

Answer the following questions:

Exercise 1 (3pts) Cell Division

Choose the correct answer(s), and justify your choice**.**

1- During anaphase I of meiosis:
- **a-** Homologous chromosomes separate.
- **b-** Sister chromatids of the same chromosome separate.
- **c-** Chromosomes of the same pair of chromosomes separate.

2- The chromosomal formula of a boy with trisomy 21 is:
- **a-** 45, XY,- 21
- **b-** 47, XXY
- **c-** 47, XY ,+21

3- At the end of mitosis, each daughter cell has:
- **a-** Half the number of chromosomes as that of the mother cell.
- **b-** The same number of chromosomes as the mother cell.
- **c-** The same genetic information as the mother cell.

Exercise 2 (6 pts) Malnutrition

Theo, a small African child, is weaned at the 15th month and he is nourished cereals, potato tuber or banana. Few months later, he showed the following symptoms: frequent vomiting, persistent diarrhea, swollen belly, significant foot edema, growth and developmental problems, change in skin and hair color (rust color), pale and fatigue. His parents were worried and consulted a health association.

1. Pick out 4 visible symptoms shown by this child.

The document below represents the variations in the mass of Theo as a function of his age.

Weaning ↓

Age (in months)	0	6	12	15	24	30	36
Mass (in Kg)	4	5	7	8	6	7	7

2. Draw the curve that represents the variation of the mass of Theo as a function of his age.

3.1 Analyze the obtained results.

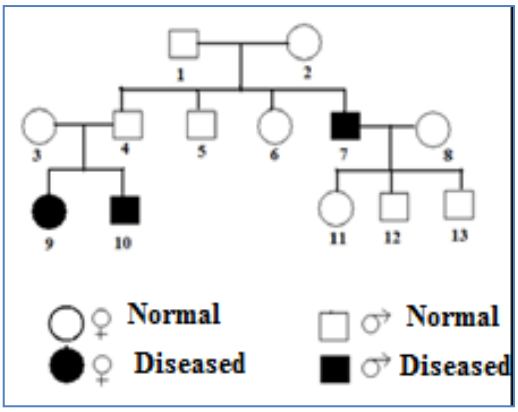
3.2 Draw out at what age the growth problem appears.

4. Justify the following statement: "The problem of Theo is due to malnutrition".

5. Indicate two kinds of food that may help Theo to overcome his problem.

Exercise 3 (6 pts) Autosomal Disease

Sickle cell anemia is a hereditary disease characterized by the synthesis of abnormal hemoglobin. The gene responsible for this disease is located on the chromosome pair No. 11. The adjacent pedigree represents the genealogical tree of a family which some of its members are affected.



1. Specify if the allele responsible for this disease is dominant or recessive.
2. Designate by symbols the corresponding alleles.
3. Determine the genotype of each of the individuals 1, 6, 10 and 11.
4. Show that, if female 9 marries a homozygous normal male, then all her children will not be diseased.

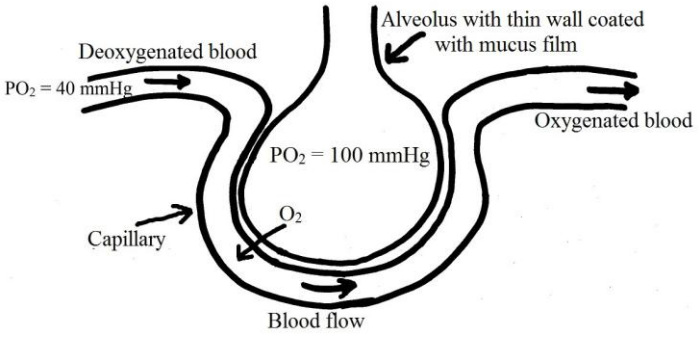
Exercise 4 (5pts) Asthma

The results of studies performed on Asthma, a chronic disease, which affects the respiratory airways in the lungs, are presented in documents 1 and 2.

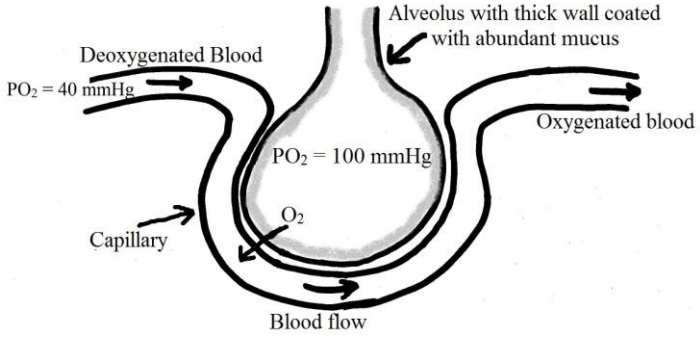
The respiratory airways, or bronchial tubes, allow air to come in and out of the lungs. The airways of an asthmatic person are always inflamed and constricted. The walls surrounding the airways become even more swollen and the muscles around them can tighten when an external factor, such as dust, triggers these reactions. This makes it difficult for air to move in and out of the lungs, resulting in symptoms such as coughing, wheezing, shortness of breath, chest tightness and muscle fatigue.

Document 1

1. Pick out from the text 2 symptoms of asthma.



Scheme (a): Normal person



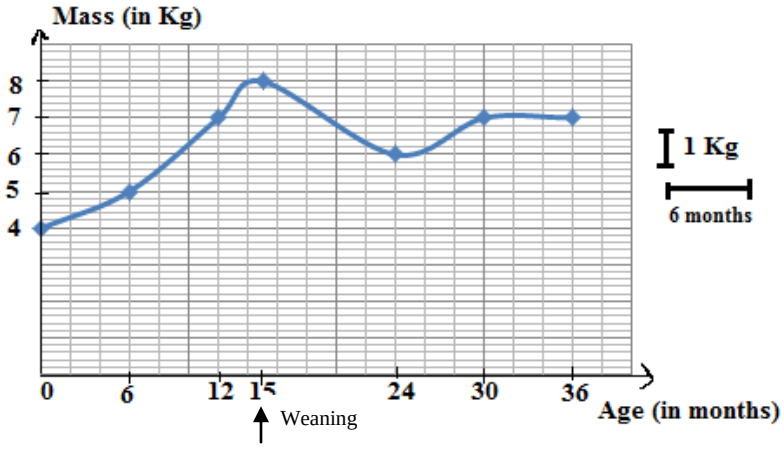
Scheme (b): Asthmatic person

Document 2

2. List the characteristics of alveoli that make them an efficient surface of gaseous exchange.
3. Compare, by referring to document 2, the alveolar wall of a normal person to that of an asthmatic one.
4. Explain why in an asthmatic person:
   - **4.1-** the circulation of air is difficult.
   - **4.2-** the muscles get fatigued.

المركز التربوي للبحوث والإنماء	الهيئة الأكاديميّة المشتركة قسم : العلوم	المادة: علوم الحياة والارض الشهادة: المتوسطة نموذج رقم -٢- المدّة : ساعة واحدة

أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدّل للعام الدراسي 2016 - 2017 وحتى صدور المناهج المطوّرة)

Ex	part	Exercise 1(3 points)	Mark
1	1	**a-c** Correct Since during the first meiotic division, there is a reduction in the number of chromosomes. This happens during anaphase I, when the homologous chromosomes of the same pair separate and in each pole there will be half number of the chromosomes of that of the mother cell. This corresponds to a and c.	**0.25** **0.75**
	2	**c-** Correct Having trisomy 21, this boy has 3 chromosomes 21 instead of 2, and the number of autosomes becomes 45 instead of 44, which is found in a normal individual. In addition, since he is a boy then he has two sex chromosomes X and Y. Therefore, the number of chromosomes becomes 47 instead of 46 and the chromosomal formula is 47,XY, + 21	**0.25** **0.75**
	3	**b** and **c** - Correct Since mitosis is a conformed, equational division where the number of chromosomes of the mother cell is conserved in each of the two daughter cells, consequently the genetic information is conserved.	**0.25** **0.75**
Ex	**Part**	**Exercise 2 (6 points)**	**Mark**
2	1	Frequent vomiting, persistent diarrhea, swollen belly, significant foot edema, growth and developmental problems, change in skin and hair color (rust color), pale and fatigue. (4 symptoms only)	**1**
	2	 **The variation of the mass of Theo as a function of his age**	**2**
	3.1	The mass of Theo increases from 4 Kg to 8kg between 0 and 15 months. However, his mass decreases slightly to 6kg at the age of 24 months after being weaned at the 15th month. On the other hand, his mass increases slightly from 6 to 7 Kg (1 Kg) between 24 months and 30 months, and it remains constant until the 36th month.	**1**
	3.2	The growth problem appeared at the 24th month.	**½**

	4	The problem of Theo starts to appear 9 months after weaning and feeding on foods poor in proteins such as cereals. Hence, the problem of Theo is due to malnutrition.	**1**
	5	Meat and fish (food rich in proteins)	**½**
Ex	**Part**	**Exercise 3 (6 points)**	**Mark**
3	**1**	The allele responsible for this disease is recessive because the normal couple 1 and 2 gives birth to a sick boy 7. This means that the allele responsible for the disease is present in the parents but masked and not expressed phenotypically.	**1**
	2	Let (N) be the symbol of the dominant allele responsible for the normal phenotype. Let (d) be the symbol of the recessive allele responsible for the sickle cell anemia disease.	**0.5**
	3	**Individual 1,** being normal, then he must possess the dominant allele N. He has an affected child 7, a recessive phenotype that is only expressed in the homozygous state, so the genotype of child 7 should be dd. This child 7 certainly receives an allele d from each of his parents. This means that, father 1 possesses allele d. Hence, father 1 is heterozygote of genotype Nd. Individual 7 gives certainly allele d to his child 11, so individual 11 possesses allele d. Since individual 11 is normal, then he possesses the dominant allele N. Therefore, **individual 11** is heterozygote of genotype Nd. **Individual 6**, being normal with a dominant phenotype, then she must possess the dominant allele N. A dominant allele is always expressed phenotypically whether in the homozygous or in the heterozygous state. This means, the second allele can be either N or d since each of her parents has the genotype Nd and she can receive from them either allele N or allele d. Therefore, her genotype can be either NN or Nd. **Individual 10** is diseased with recessive phenotype. A recessive allele is only expressed phenotypically when it is present in two copies (homozygote). Therefore, the genotype of individual 10 is dd.	**3**
	4	Woman 9 is diseased. Since this disease is recessive and is only expressed phenotypically in the homozygous state, then her genotype is certainly dd. She can give her children only the recessive allele d. If this woman marries a normal homozygote man of genotype NN, this man can give his children only the dominant allele N. A dominant allele can be expressed phenotypically either in the homozygous or the heterozygous state. Therefore, all their children will be normal of genotype Nd.	**1.5**
Ex	Part	**Exercise 4 (5 points)**	**Mark**
4	**1**	The symptoms of asthma are: coughing, wheezing, shortness of breath, chest tightness and muscle fatigue. (any 2 symptoms)	**1**
	2	Alveoli are characterized by large surface areas, thin wal1s, and they are richly vascularized.	**1**
	3	The alveolar walls of a normal person are thinner than those of an asthmatic patient. The alveolar walls of a normal person are coated with a thin film of mucus while those of an asthmatic person are covered with abundant mucus.	**1**
	4.1	In an asthmatic individual, the airways are constricted and in a state of inflammation, and the muscles surrounding them are tightened, and these render the circulation of the air difficult at this level leading to breathing difficulties.	**1**
	4.2	In an asthmatic individual, the walls of the alveoli are thick and covered with mucus, which hinders the diffusion of oxygen gas towards the blood. The drop of oxygen gas decreases the oxidation reactions that provide energy, and this explains muscle fatigue.	**1**