

الاسم:
الرقم:

مسابقة في مادة علوم الحياة والأرض
المدة: ساعة واحدة

Answer the following four exercises

Exercise 1 (4 points) Meiosis

Correct the following incorrect statements:

1. The duplication of chromosomal material takes place between the two meiotic divisions.
2. During meiosis, a mother cell of $2n$ chromosomes gives two daughter cells, each of n chromosomes.
3. The first meiotic division is an equational division.
4. The homologous chromosomes separate during the anaphase of the second meiotic division.

Exercise 2 (5 points) Transmission of Rhesus factor in humans

The Rhesus factor is one of the substances which characterize the blood group in humans. It is determined by a gene located on the pair of chromosomes N° 1. This gene exists in two forms:

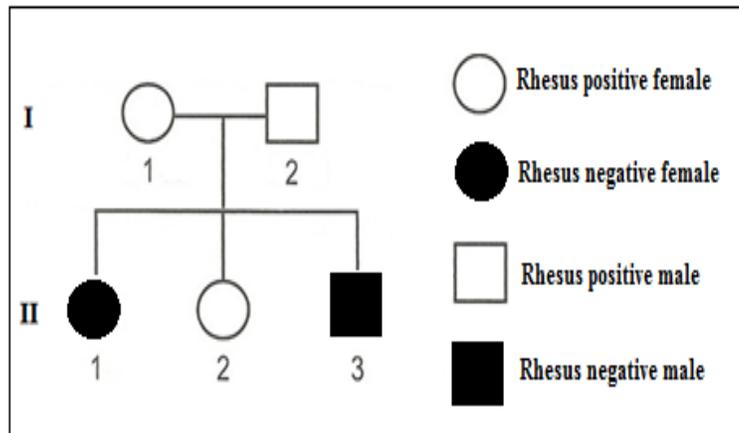
- The allele which determines the rhesus positive phenotype (Rh^+)
- The allele which determines the rhesus negative phenotype (Rh^-)

An individual is of a positive blood group if he possesses two alleles rhesus positive or an allele rhesus positive with an allele rhesus negative.

1. Justify the following statement: "the gene determining the Rhesus factor is autosomal."
2. Specify the dominant allele of the studied gene.

The adjacent document shows the transmission of the Rhesus factor in a family.

3. Determine the genotypes of the parents I_1 and I_2 .
- 4-1. Indicate the genotype(s) of individual II_2 .
- 4-2. Localize the alleles on the pair of chromosomes N°1 of individual II_2 .



Exercise 3 (6 points)

A Vascular Disease: Aneurysm

Aneurysm is characterized by a deformation in a region in the wall of an artery which may lead to its rupture. If the rupture occurs in the brain, a cerebral hemorrhage will occur.

1. Pick out from the text:

1-1. the characteristic of aneurysm.

1-2. the consequence of a rupture in the cerebral artery.

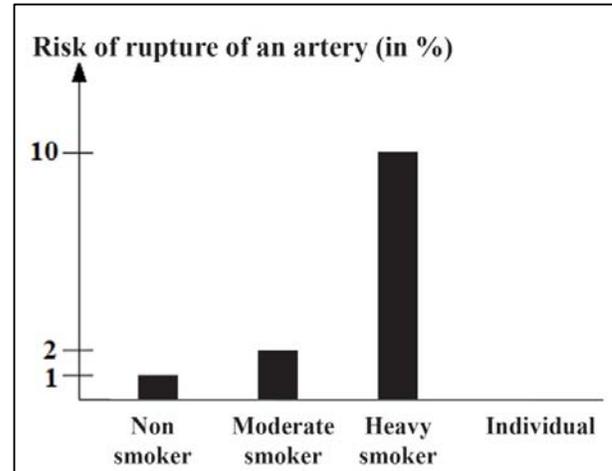
A study is performed to determine the effect of smoking tobacco on Aneurysm. The obtained results are represented in the adjacent document.

2. Draw a table representing the obtained results.

3. Show that smoking tobacco favors the risk of cerebral hemorrhage occurrence.

4-1. Compare the risk of rupture of an artery in a moderate smoker to that in a heavy smoker.

4-2. What can you draw out?



Exercise 4 (5 points)

Treatment of anemia by E.P.O.

Anemia is characterized by a low count of red blood cells and/or low amount of hemoglobin in blood. It might be due to a deficiency in iron intake. Also, it might be due to a decrease in a substance called erythropoietin (E.P.O), produced by the kidneys. This substance is indispensable for the production of red blood cells in blood.

1- Pick out from the text:

1-1. the characteristics of anemia

1-2. the role of E.P.O

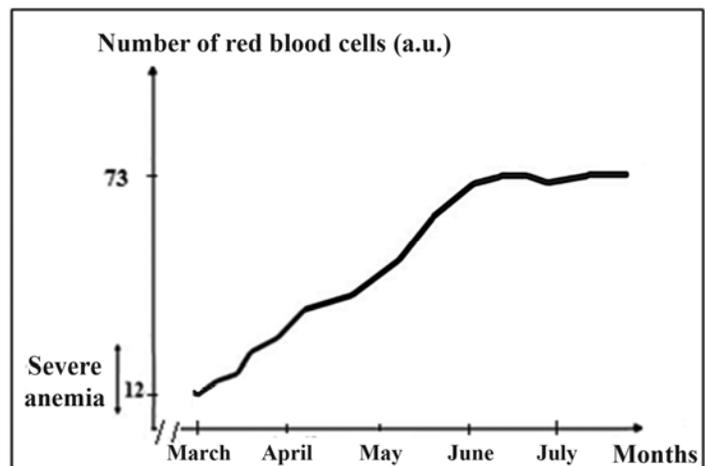
1-3. the role of the kidney.

2. Explain why an anemic person always feels tired.

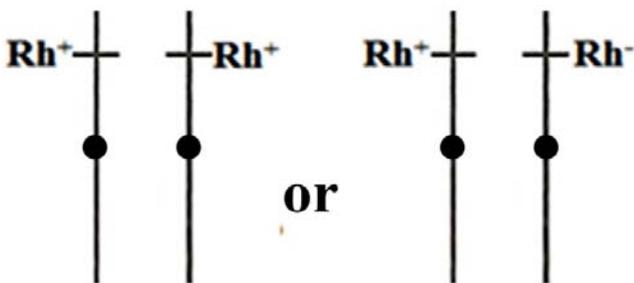
A study was carried out on anemic patients treated by (E.P.O) for several months. The obtained results are represented in the adjacent document.

3-1. Analyze the obtained results.

3-2. What can you conclude?



Part Of the Q	Answer Key (4points) Meiosis	Mark
1	The duplication of the chromosomal material takes place before the two meiotic divisions.	1
2	During meiosis, a mother cell of 2n chromosomes gives four daughter cells, each of n chromosomes.	1
3	The first meiotic division is a reductional division. Or The second meiotic division is an equational division.	1
4	The homologous chromosomes separate during the anaphase of the first meiotic division.	1

Part of the Q	Answer key (5 points) Transmission of Rhesus factor in humans	Mark
1	Since the gene determining the Rhesus factor is located on the pair chromosome N° 1 which is an autosome; thus, this gene is autosomal.	0.5
2	The allele Rh ⁺ is dominant over the allele Rh ⁻ which is recessive, because when the two alleles Rh ⁺ and Rh ⁻ are present in an individual, the allele Rh ⁺ is only expressed phenotypically.	1
3	Since each of the two parents I ₁ and I ₂ is phenotypically rhesus positive, this means that each has the allele Rh ⁺ . Moreover, they have given birth to two children II ₁ and II ₃ who have the phenotype [Rh ⁻], recessive and recessivity is a characteristic of purity, thus they must have obtained the allele Rh ⁻ from each parent. Thus, each parent has one allele Rh ⁺ and one allele Rh ⁻ . Therefore the genotype of each is Rh ⁺ // Rh ⁻ .	1.5
4-1	The genotype of II ₂ is Rh ⁺ // Rh ⁺ or Rh ⁺ // Rh ⁻	1
4-2	 <p>Pair of chromosomes N°1 of individual II₂</p>	1

Part of the Q	Answer Key (6 points) Vascular Disease, Aneurysm	Mark								
1-1	Aneurysm is characterized by a deformation in a region in the wall of an artery.	0.75								
1-2	The consequence of a rupture in the cerebral artery is a cerebral hemorrhage.	0.75								
2	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 45%;">Individual</th> <th style="width: 15%;">Non-smoker</th> <th style="width: 15%;">Moderate smoker</th> <th style="width: 25%;">Heavy smoker</th> </tr> </thead> <tbody> <tr> <td>Risk of rupture of an artery (in %)</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">10</td> </tr> </tbody> </table> <p>Table showing the variation of risk of rupture of an artery in different individuals.</p>	Individual	Non-smoker	Moderate smoker	Heavy smoker	Risk of rupture of an artery (in %)	1	2	10	2
Individual	Non-smoker	Moderate smoker	Heavy smoker							
Risk of rupture of an artery (in %)	1	2	10							
3	The risk of rupture of an artery increases from 1% in a non-smoker to 2% (doubles) in a moderate smoker. Therefore smoking tobacco favors the rupture of an artery. Consequently it favors the risk of occurrence of cerebral hemorrhage.	1								
4-1	The risk of rupture of an artery in a moderate smoker is 2% (5 times) less than that in a heavy smoker (10%).	0.75								
4-2	The increase in the consumption of tobacco favors the occurrence of rupture of an artery.	0.75								

Part of the Q	Answer Key (5 Points) Treatment of anemia by E.P.O.	Mark
1-1	Anemia is characterized by a low count of red blood cells and/or low amount of hemoglobin in blood.	0.5
1-2	E.P.O. is indispensable for the production of red blood cells in blood.	0.5
1-3	The kidney produces a substance called erythropoietin (E.P.O)	0.5
2	Oxygen gas is indispensable for cellular oxidation reaction which produces energy utilized for the cellular activities. Since anemic persons suffer from a deficiency in red blood cells which are responsible for the transport of this respiratory gas (oxygen gas), thus less amount of oxygen gas diffuses into the cells leading to a decrease in the production of energy, which explains the tiredness in the anemic persons.	1.5
3-1	Under the effect of E.P.O treatment, the number of red blood cells increases from 12 a.u. (which corresponds to severe anemia) to 73 a.u (6 times) starting from March to June while it remains constant at 73 a.u till July.	1.5
3-2	The treatment with E.P.O favors the production of red blood cells.	0.5