وزارة التّربية والتّعليم العالي المديريّة العامّة للتّربية دائرة الامتحانـات الرّسميّة	امتحانات الشّهادة المتوسّطة	دورة العام ٢٠١٨ الاستثنائية الخميس ٩ آب ٢٠١٨

مسابقة في مادّة علوم الحياة والأرض الاسم:
المدّة: ساعة واحدة الرّقم:

Answer the following four exercises.

Exercise 1 (4 points) Valvular Heart Diseases

Valvular heart diseases are due to the dysfunction of one or more of the heart valves. These valves are responsible for the regulation of blood flow through the heart and large blood vessels. Valve dysfunction leads to a diminished heart activity. There are two types of valvular heart diseases:

- Valvular stenosis occurs when the opening of the valve narrows.
- Valvular insufficiency occurs when the valve does not close tightly (completely). In this case, the blood flows back into the previous cavity of the heart.

Valvular insufficiency and valvular stenosis force the heart to exert more effort to maintain a normal flow of blood into the body. Consequently, it cannot propel enough blood to the body organs.

1.1. Name one valve of the heart.
1.2. Indicate its location.
2. Pick out from the text, the characteristic of the valve in each of the two types of valvular heart diseases.
3. Draw out, by referring to the text, the role of a valve.
4. Explain why a valvular heart disease leads to a feeling of fatigue in the affected individual.

Exercise 2 (5 points) Urinary Excretion

Urinary excretion permits the body to get rid of the wastes produced by the organs. These wastes are carried by blood to the kidneys where they are eliminated in the form of urine.
To determine the role of the kidney, the composition of the blood entering and leaving the kidneys as well as the composition of urine are studied in a healthy individual. The obtained results are represented in the table below.

Constituents (g/l)	Blood entering the kidney	Blood leaving the kidney	Urine
Water	920	900	950
Proteins	80	80	0
Urea	0.3	0.2	20

1. Draw out, by referring to the table, the constituents of urine.
2.1. Compare the level of urea in the blood entering the kidney to that in the blood leaving the kidney**.**
2.2. Compare the level of urea in the blood entering the kidney to that in the urine.
2.3. What can you conclude concerning the role of the kidney?
3. Show, by referring to the table, that the kidneys do not eliminate proteins from blood**.**
4. Justify, by referring to the table, the following statement: "Excess water is eliminated from the blood into the urine".

Exercise 3 (5 points) Childhood Obesity

Obesity is the most common nutritional disorder affecting children. This disorder increases the risk of diabetes and hypertension occurrence. To study the evolution of obesity rate in Europe, researches were performed between 1990 and 2005 on six years old children. The results are presented in the table below.

Year	Obesity rate (%)
1990	7
2000	18
2005	21

1. Pick out from the text, the consequences of obesity.
2. Construct a histogram representing the results shown in the adjacent table.
3. Determine the evolution of obesity rate in Europe between 1990 and 2005 among six years old children.

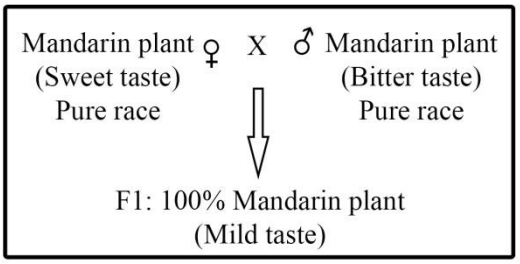
A widely used formula which measures the degree of obesity is the body mass index (BMI):
BMI = m/ h^2 (m represents the mass in Kg and h represents the height in m).

The BMI of a 6-year-old boy is considered normal if it is equal to 15.5 . However, he is considered obese if his BMI is greater than 18.5 and underweight if his BMI is less than 13.4 .

Sami, a six-year old boy has a mass of 30 Kg and a height of 1.2m. His parents are wondering if he is obese or not.
4.1. Calculate the BMI of Sami.
4.2. Verify if Sami is obese or not.

Exercise 4 (6 points) Transmission of a Hereditary Trait in Mandarin Plants

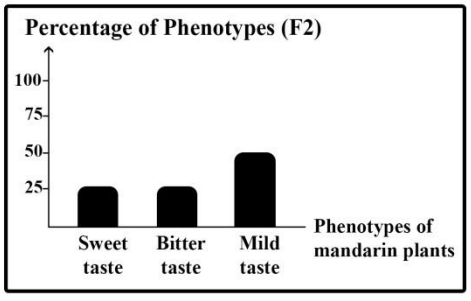
To determine the type of inheritance of the gene responsible for the taste of mandarin fruits, a cross is performed between two varieties of mandarin plants that differ by one trait only.
The cross and its results are represented in document 1.



Document 1

1. Specify the type of inheritance studied in mandarin plants.
2. Designate by symbols the corresponding alleles.
3. Write, by referring to document 1, the genotypes of each of the two parents and their descendants.

The descendants of F_1 generation are self-crossed (F_1 x F_1).
The phenotypic results of the descendants of this cross (F_2) are represented in document 2.

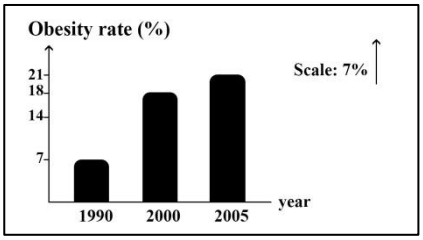


Document 2

4. Make the necessary factorial analysis to verify the phenotypic results represented in document 2.
5. Verify if it is necessary to perform a test cross to determine the real genotypes of the descendants of the 2nd generation (F_2).

Part Of the Q	Answer Key Exercise 1 (4 points) Valvular Heart Diseases	Mark
1.1	Tricuspid valve or bicuspid valve or sigmoid valves.	0.5
1.2	The tricuspid valve is located between the right atrium and the right ventricle. Or The bicuspid valve (mitral) is located between the left atrium and the left ventricle Or The sigmoid valves are found at the base of the aorta and the pulmonary artery.	0.5
2	- The opening of the valve is narrowed in the case of valvular stenosis. - The valve does not close completely in the case of valvular insufficiency.	0.5 0.5
3	The valve does not allow the back flow of blood into the previous cavity of the heart.	1
4	Valvular heart disease forces the heart to exert more effort to maintain a normal flow of blood into the body. Consequently, it cannot propel enough blood to the organs. This leads to a decrease in the supply of oxygen gas and nutrients (glucose) to the organs, resulting in a decrease in the rate of cellular oxidation; thus leading to a decrease in the production of energy necessary for cellular functioning. This drop of energy provokes a feeling of fatigue in the affected individual.	1

Part of the Q	Answer Key Exercise 2 (5 points) Urinary Excretion	Mark
1	The constituents of urine are: water and urea.	1
2.1	The level of urea in the blood entering the kidneys (0.3 g / L) is greater than the level of urea in the blood leaving the kidneys (0.2 g / L).	0.5
2.2	The level of urea in the blood entering the kidneys (0.3 g / L) is less than that of the formed urine (20 g / L).	0.5
2.3	The kidneys purify the blood from the excess of urea and eliminate it into the urine.	1
3	The concentration of proteins is the same in the blood entering and leaving the kidneys (80g/L); Moreover, there is absence of proteins (0 g/L) in the urine, this shows that the proteins are not eliminated by the kidneys.	1
4	The concentration of water in the blood entering the kidney is 920 g / L which is greater than that in the in the blood leaving the kidneys (900 g /L); however, the concentration of water in the urine is the greatest (950 g /L). This shows that the kidney eliminates the excess of water from blood to the urine.	1

Part of the Q	Answer key Exercise 3 (5 points) Childhood Obesity	Mark
1	The consequences of obesity are the increase in the risk of diabetes and hypertension occurrence.	**1**
2	Histogram showing the variation of the obesity rate among six years old children between 1990 and 2005.  	**2**
3	In 1990 the obesity rate among 6 years old children is 7%, it increases to 21% (3 times more) in 2005, this shows that the percentage of childhood obesity increases with time (amplified).	**1**
4.1	Sami's BMI BMI = m/h^2 = 30 Kg/ $(1.2m)^2$ = 20.383	**0.5**
4.2	The result shows that the BMI of Sami (20.383) is greater than the BMI of an obese boy (18.5). Therefore, Sami is considered obese.	**0.5**

Part of the Q	Answer Key Exercise 4 (6 points) Transmission of Hereditary Trait in Mandarin Plants	Mark
1	It is an incomplete dominance (intermediate), because the cross between the two pure race parents, the bitter taste mandarin and the sweet taste mandarin plant, gives rise to intermediary phenotype descendants in F_1 generation, mild taste mandarin plants. These latter receive one allele responsible for sweet taste from the female and one allele responsible for bitter taste from the male; however, neither of the alleles is expressed in F_1 generation. This means that both alleles are incompletely dominant.	**0.25** **0.75**
2	Let "S" be the symbol of the allele coding for the "sweet taste". Let B be the symbol of the allele coding for "bitter taste".	**0.25** **0.25**
3	The genotype of ♀ parent is: SS, the genotype of ♂ parent is: BB The genotype of the descendants of the F_1 generation is: BS	**0.75**
4	Factorial analysis: Phenotypes of the parents : Mandarin plant of "Mild taste" ♀ x ♂ Mandarin plant "Mild taste" Genotypes of the parents: ♀ BS x ♂ BS Gametes of parents: 50% (B) 50% (S) 50% (B) 50% (S) Table of cross: γ♂ / γ♀ | 50% B | 50% S 50% B | 25 % BB | 25% BS 50% S | 25% BS | 25% SS Phenotypic percentages : 25% [B],25% [S], 50% [BS] The histogram (document 2) represents 3 different phenotypic percentages: 25% of the mandarin plants having "sweet taste"; 25% of mandarin plants having "bitter taste"; 50% of mandarin plants having mild taste. Thus, the theoretical results verify the experimental ones.	**3**
5	No, it is not necessary to perform the test cross, because the descendants who have the same phenotype as their parents (sweet and bitter taste) are of pure race having the same genotypes as their parents and those of intermediate phenotype (mild taste) are hybrids (heterozygous).	**0.75**