

Answer the following four exercises.

مسابقة في مادة علوم الحياة والأرض

المدة: ساعة واحدة

(باللغة الإنكليزية)

الاسم:

الرقم:

Exercise 1 (4 points)

Valvular Heart Disease

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.

2.1. Pick out from the text the characteristic of the valve in the case of Valvular stenosis.

2.2. Pick out from the text, the characteristic of the valve in the case of valvular insufficiency.

2.3. Draw out, by referring to the text, the role of the 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, we study in a healthy individual:

- The composition of the blood entering the kidney
- The composition of blood leaving the kidneys
- The composition of urine.

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. **Conclude** the role of the kidney.

3.1. **Compare** the level of proteins in “the blood entering the kidney” to that in “the blood leaving the kidney”.

3.2. What can you draw out?

4.1. **Compare** the level of water in “the blood entering the kidney” to that in “the blood leaving the kidney”.

4.2. **Compare** the level of water in “the blood entering the kidney” to that in “the urine”.

4.3. **Conclude** the role of kidney.

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 on six years old children

A widely used formula which measures the degree of obesity is the body mass index (BMI):

$$\text{BMI} = m / h^2 \text{ (m represents the mass in Kg and h represents the height in m).}$$

A 6-year-old boy is considered:

- **Normal** if his BMI is **equal** to **15.5**.
- **Obese** if his BMI is **greater** than **18.5**
- **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**.

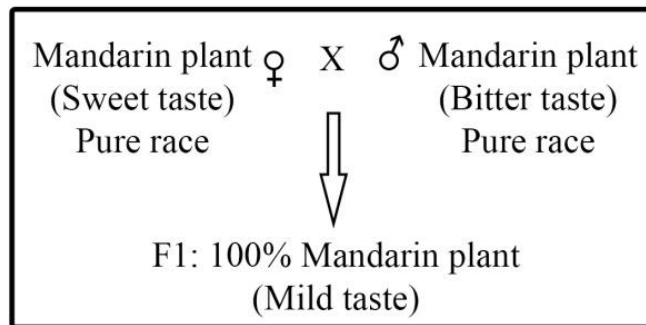
- 4.1. **Calculate** the BMI of Sami, knowing that **BMI = m/ h²**
- 4.2. **Verify** if Sami is obese or not.

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.

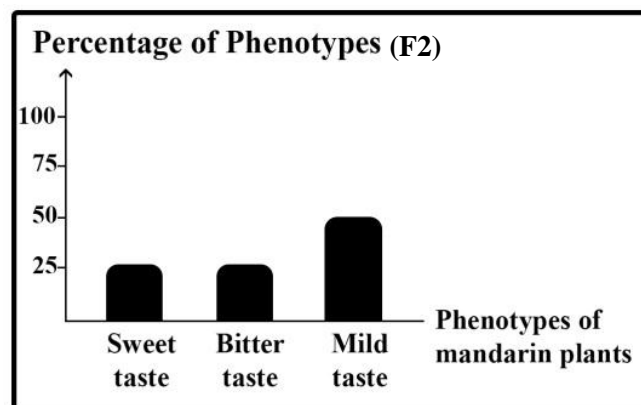


Document 1

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 ($F_1 \times F_1$).

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 2nd generation (F_2).