مسابقة في مادة علوم الحياة والأرض
المدة: ساعة واحدة

الاسم:
الرقم:

Answer the four following exercises.

Exercise 1 (5 points) Incomplete Dominance

In order to study the transmission of the hereditary trait, the color of flowers in plants, we perform a cross between two pure lines of plants, one with yellow flowers and the other with blue flowers. All plants that are obtained in the first generation $\mathbf{F_1}$ have flowers of violet color.

1- Show that the alleles of the gene that determines the color of the flowers are incompletely dominant.

2- Designate by symbols the corresponding alleles.

3- Write the genotypes of the plants of each of the parents and that of $\mathbf{F_1}$ generation.

We cross hybrid plants of $\mathbf{F_1}$ generation. We obtain in $\mathbf{F_2}$ generation:
- 25% plants having blue flowers
- 25% plants having yellow flowers
- 50% plants having violet flowers.

4- Make a factorial analysis that permits to verify the obtained result in $\mathbf{F_2}$ generation.

Exercise 2 (5 points) The Substances Exchanged at the Level of the Organs

Blood provides the nutrients (glucose) and oxygen gas to organs and it eliminates their wastes (carbon dioxide). To verify this, one measure the quantity of the three substances in 100 ml of blood entering and leaving the muscle. The results are presented in the document below.

Measured substances	Blood entering the muscle	Blood leaving the muscle
Oxygen gas (in mL/100 mL of blood)	**20**	**15**
Carbon dioxide (in mL/100 mL of blood)	**48**	**52**
Glucose (in mg/100 mL of blood)	**90**	**87**

1- Draw a histogram showing the levels of oxygen gas and carbon dioxide in the blood entering and leaving the muscle.

2a- Compare the level of each of the measured substances in the blood entering and leaving the muscle.

b- What do you conclude?

3- Name the chemical reaction at the origin of the variation in the levels of the measured substances**.**

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Exercise 3 (5 points) Rhesus System

In human species, the Rhesus blood group is a hereditary trait that is determined by a gene carried by chromosome **1**. This gene has two alleles:

- The allele **D** determines the positive Rhesus blood group.
- The allele **d** determines the negative Rhesus blood group.

The individual having Rhesus positive possesses either the alleles **D** and **D** or **D** and **d**. The individual having Rhesus negative possesses the alleles **d** and **d**.

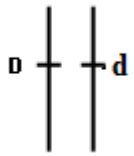
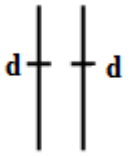
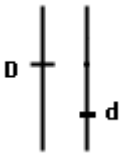
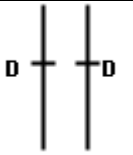
1- Indicate if the gene determining the Rhesus blood group is carried on an autosome or a sex chromosome. Justify the answer.

2- Determine, for this gene, the number of alleles that are found in each of the following cells:

a- a skin cell

b- a gamete.

The chromosomic representations that show the localization of the alleles of this gene, in a Rhesus positive individual, are represented in the document below.

Chromosomal representations of alleles				
	1	**2**	**3**	**4**

3- Identify the **incorrec**t representation(s).

Exercise 4 (5 points) Cardiac Abnormality

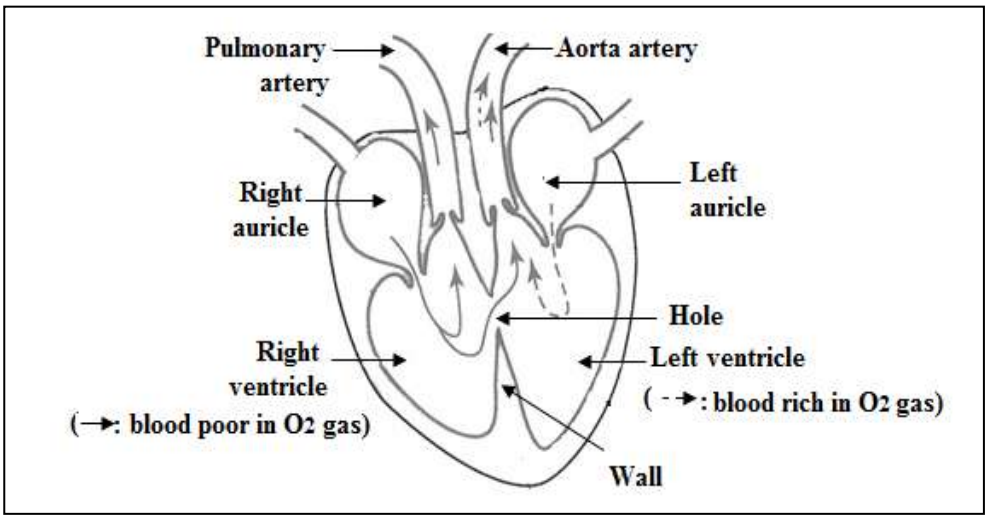
Certain children show the following signs: bluish lips, accelerated respiration, lack of energy... In these children, the heart shows the presence of a hole in the wall between the right ventricle and the left ventricle (the document below).

1- Pick out from the text:

a- The cause of this cardiac abnormality.

b- The signs of this abnormality.

The adjacent **document** shows the sense of direction of the passage of blood in the heart of a child affected by this abnormality.



2- Indicate, by referring to the document, the pathway of blood leaving the right auricle towards the arteries.

3- Specify, by referring to the document, if the blood leaving the aorta artery becomes poorer or richer in oxygen gas than the blood in the left auricle

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4- Explain why those children, affected by this abnormality, have a lack of energy.

مشروع معيار التصحيح

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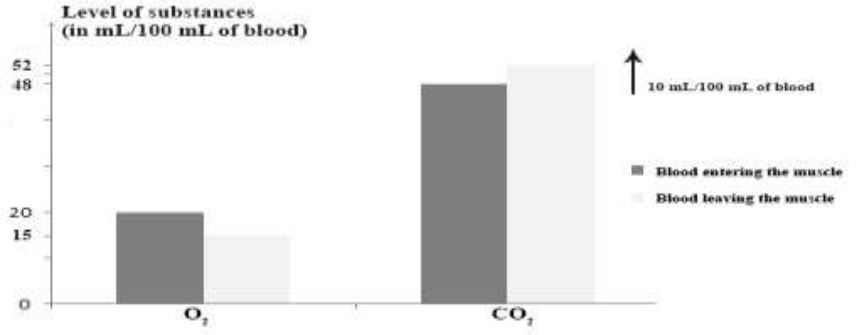
Answer the four following exercises:

Exercise 1(5 points)

Part of the Q	Answer	Mark
1	The plants in F_1 having an intermediate phenotype (violet flowers) are hybrids. They possess the two alleles, allele determining the yellow color and the other allele determining the blue color that is not expressed in their phenotypes. Thus these two alleles are incompletely dominant.	1
2	Symbol of the alleles: Let Y be the symbol of the allele determining the yellow color of flowers. Let B be the symbol of the allele determining the blue color of flowers.	0.5
3	Genotypes of the parents : Plants having yellow flowers: **YY** Plants having blue flowers: **BB** Genotype of plants of F_1 : **YB**	1.5
4	Factorial analysis : Genotypes of the parents : ♂ **YB** × ♀ **YB** Gametes of the parents: (Y) (B) (Y) (B) **50% 50% 50% 50%** **Table of cross:** ♂ / ♀ | **Y** 50% | **B** 50% **Y** 50% | **YY** 25% | **YB** 25% **B** 50% | **YB** 25% | **BB** 25% Phenotypic results : **25% [Y] ; 25% [B] ; 50% [YB]** The experimental result are confirmed	2

Exercise 2 (5 points)

Part of the Q	Answer	Mark
1	 **Histogram showing the levels of oxygen gas and carbon dioxide in the blood entering and leaving the muscle**	2
2-a	The level of oxygen gas, in the blood entering the muscle, is 20 ml/100 mL of blood, greater than that in the blood leaving the muscle which is 15 ml/100 mL of blood. The level of carbon dioxide, in the blood entering the muscle is 48 ml/100 mL of	

	blood is less than that of the blood leaving the muscle which is 52 ml/100 mL of blood. The level of glucose in the blood entering the muscle is 90 mg/100 mL of blood is greater than that in the blood leaving the muscle which is 87mg/100 mL of blood.	**1.5**
2-b	We conclude that the muscle consumes oxygen gas and glucose and produces carbon dioxide.	1
3	This is an Oxidation reaction	**0.5**

Exercise 3 (5 points)

Part of the Q	Answer	Mark
1	The gene determining the Rhesus blood group is carried on an autosome, since this gene is carried by chromosome **1** which is an autosome.	**1**
2-a	The skin cell, a somatic cell, has a pair of chromosomes 1. Since each chromosome carries an allele of the gene, thus the number of alleles of the gene determining the Rhesus blood group is **2**.	**1**
2-b	The gamete, a sex cell, has one chromosome **1.** Since each chromosome carries an allele of the gene, thus the number of alleles of the gene determining the Rhesus blood group is **1**.	**1**
3	A positive Rhesus individual must have a chromosomic representation of alleles DD or Dd which does not correspond with the representation **2**. Thus the chromosomic representation of alleles in **2** is incorrect. The alleles of the same gene must occupy the same locus on homologous chromosomes, which does not correspond with **3** which shows two alleles of the same gene at two different loci. Thus the chromosomic representation of alleles in **3** is incorrect.	**2**

Exercise 4(5 points)

Part of the Q	Answer	Mark
1-a	The heart of these children presents a hole in the wall between the right ventricle and the left ventricle.	**0.75**
1-b	The bluish lips, accelerated respiration, lack of energy…	**0.75**
2	The blood passes from the right auricle to the right ventricle. Part of it continues through the pulmonary artery and another part passes to the left ventricle then through the aorta artery.	**1.5**
3	The blood leaving the aorta artery becomes poorer in oxygen gas than the blood in the left auricle because it is receiving blood rich in oxygen gas coming from the left ventricle mixed with the blood poor in oxygen gas coming from the right ventricle.	**1**
4	The cells need oxygen gas to produce energy. Then, in those children having this abnormality, the blood leaving the aorta is poor in **O_2 gas**, so the quantity of oxygen gas received by the cells diminishes resulting in less production of energy.	**1**