مسابقة في مادّة علوم الحياة والأرض
المدّة: ساعة واحدة

الاسم:
الرّقم:

Answer the following four exercises.

Exercise 1 (5 points) Cellular Divisions

Correct the following statements.

1. During prophase of mitosis, each chromosome is of one chromatid.

2. The homologous chromosomes separate during anaphase of mitosis.

3. At the end of mitosis, a mother cell gives four daughter cells.

4. Meiosis II is a reductional division.

5. Decondensation of chromosomes takes place during prophase of mitosis.

Exercise 2 (5 points) Respiratory Gas Exchange

The exchange of oxygen gas (O_2) and carbon dioxide (CO_2) takes place between alveolar air and blood. The document below represents the percentage of oxygen gas and carbon dioxide in the inhaled air and that in the exhaled air, as well as that in the blood entering and in the blood leaving the lungs.

1. Pick out from the adjacent document:

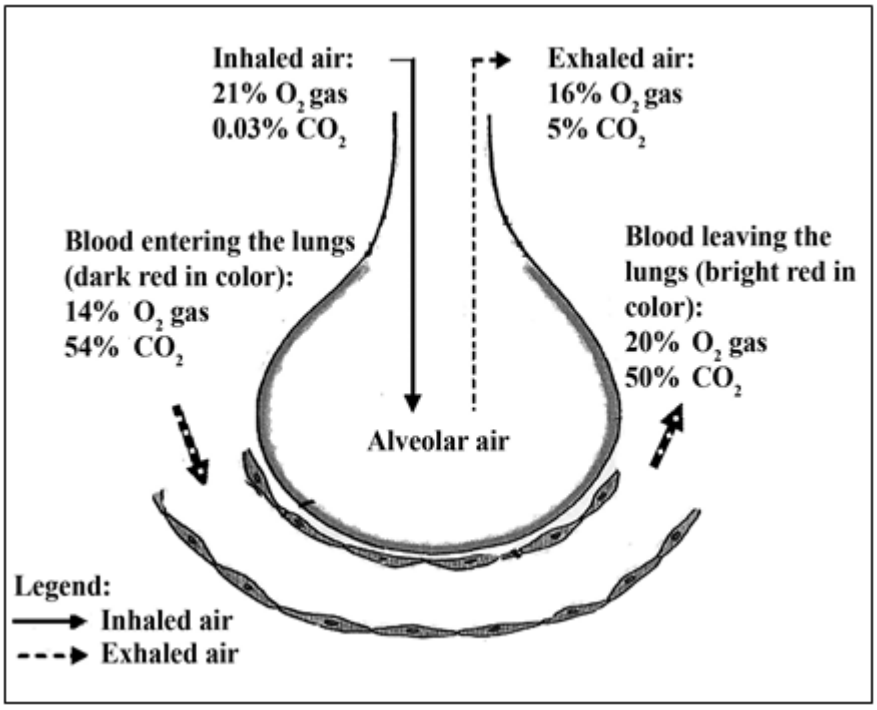
1-1. The color of blood entering the lungs.

1-2. The color of blood leaving the lungs.

2-1. Compare the composition of the inhaled air to that of the exhaled air in oxygen gas and carbon dioxide.

2-2. What do you conclude?

3. Show, by referring to the adjacent document, that the blood leaving the lungs is enriched in oxygen gas and impoverished in carbon dioxide.



4. Draw out the direction of the passage of oxygen gas and that of carbon dioxide at the level of the pulmonary alveoli.

Exercise 3 (5 points) Digestion of Sucrose

Sucrose is a non-reducing sugar formed of two simple sugars glucose and fructose. It is digested at the level of the digestive tube in the presence of a specific enzyme, sucrase.
In order to know if sucrose is digested by brewer's yeast, a unicellular fungus, the following experiment is performed:
In three test tubes A, B and C placed in a water-bath at 37°C, sucrose and water are put. Then, sucrase is added into tube B and brewer's yeast into tube C. These tubes are left in the water-bath for duration of 40 minutes.

1. Pose the problem at the origin of this experiment.

2. Pick out from the text:
2-1. the constituents of sucrose.
2-2. the specific enzyme for the digestion of sucrose.

3. Draw a table showing the conditions of this experiment.

The Fehling test permits the identification of reducing sugars such as simple sugars and disaccharides except sucrose. This test is performed on the three test tubes at the beginning and at the end of the experiment. The obtained results are represented in the adjacent document.

Tubes	A	B	C
At the beginning of the experiment	-	-	-
At the end of the experiment	-	+	+

(+): Presence of a reducing sugar
(-): Absence of a reducing sugar

4-1. Analyze the obtained results.
4-2. What do you conclude concerning the action of brewer's yeast on sucrose?

Exercise 4 (5 points) Transmission of an Autosomal Hereditary Trait

The cross between two pure lines of tomato plants, one having large fruits and the other having small fruits, gives 100% tomato plants having small fruits.

1. Specify the dominant allele and the recessive one.

2. Designate by symbols the corresponding alleles.

Two other crosses A and B are performed as shown in the following document.

	Cross			Results
A	Tomato plant having small fruits	**X**	Tomato plant having small fruits	75% Tomato plants having small fruits 25% Tomato plants having large fruits
B	Tomato plant having large fruits	**X**	Tomato plant having small fruits	50% Tomato plants having small fruits 50% Tomato plants having large fruits

3. Make a factorial analysis to verify the results of cross A.

4-1. Write the genotype of each parent in cross B. Justify the answer
4-2. Name cross B.

وزارة التّربية والتّعليم العالي
المديريّــة العامّة للتّربية
دائرة الامتحانات الرّسميّة

امتحانات الشّهادة المتوسّطة

دورة الـعام 2018 العاديّة
الخميس 31 ايار 2018

مسابقة في مادّة علوم الحياة والأرض

أسس التصحيح

Part of the Q	Answer key (5 points) Cellular divisions	Mark
1	During prophase of mitosis, each chromosome is of two chromatids.	1
2	The homologous chromosomes separate during anaphase I of meiosis I.	1
3	At the end of mitosis, a mother cell gives two daughter cells.	1
4	Meiosis II is an equational division.	1
5	Decondensation of chromosomes takes place during telophase of mitosis.	1

Part of the Q	Answer key (5 points) Respiratory gas exchange	Mark
1-1	Dark red color.	0.5
1-2	Bright red color.	0.5
2-1	The percentage of O_2 gas in the inhaled air is 21% which is greater than that in the exhaled air, 16%. The percentage of CO_2 in the inhaled air is 0.03% which is less than that in the exhaled air, 5%.	0.5 0.5
2-2	At the level of the lungs, the alveolar air is enriched in CO_2 and impoverished in O_2 gas.	0.5
3	The percentage of O_2 gas in the blood entering the lungs is 14% which is less than that in the blood leaving the lungs, 20%. Thus, the blood leaving the lungs is enriched in O2 gas. The percentage of CO_2 in the blood entering the lungs is 54% which is greater than that in the blood leaving the lungs, 50%. Thus, the blood leaving the lungs is impoverished in CO_2.	1.5
4	At the level of the pulmonary alveoli, oxygen gas passes from the alveolar air into the blood and carbon dioxide passes from the blood into the alveolar air.	1

<table>
<tr><th>Part of the Q</th><th>Answer Key (5 points)
Digestion of sucrose</th><th>Mark</th></tr>
<tr><td>1</td><td>Is brewer's yeast capable of digesting sucrose?</td><td>0.75</td></tr>
<tr><td>2-1</td><td>The constituents of sucrose are: glucose and fructose.</td><td>0.5</td></tr>
<tr><td>2-2</td><td>The specific enzyme for the digestion of sucrose is: sucrase.</td><td>0.25</td></tr>
<tr><td>3</td><td>
<table>
<tr><th>Tubes / Conditions</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Sucrose</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>Water</td><td>+</td><td>+</td><td>+</td></tr>
<tr><td>Sucrase</td><td>-</td><td>+</td><td>-</td></tr>
<tr><td>Brewer's yeast</td><td>-</td><td>-</td><td>+</td></tr>
<tr><td>Temperature (in ˚C)</td><td>37</td><td>37</td><td>37</td></tr>
<tr><td>Duration (in minutes)</td><td>40</td><td>40</td><td>40</td></tr>
</table>
Table showing the conditions of the experiment.
(+): Presence (-): absence
</td><td>2</td></tr>
<tr><td>4-1</td><td>At the end of the experiment, the reducing sugar is still absent in tube A in the presence of sucrose and water only; however, reducing sugars appear in tubes B and C, which contain sucrase and brewer’s yeast respectively in addition to sucrose and water.</td><td>1</td></tr>
<tr><td>4-2</td><td>Brewer's yeast is capable of digesting sucrose into reducing sugars.</td><td>0.5</td></tr>
</table>

<table>
<tr><th>Part of the Q:</th><th>Answer Key (5 points)
Transmission of an Autosomal Hereditary Trait</th><th>Mark</th></tr>
<tr><td>1</td><td>The allele responsible for the phenotype "small fruits" is dominant over the allele responsible for the phenotype "large fruits" which is recessive. This is because, all F1 hybrids which present the phenotype “small fruits”, receive an allele responsible for the phenotype “small fruits” from one pure line parent having small fruits and another allele responsible for “large fruits” from the other pure line parent having large fruits. However, only the allele responsible for the phenotype “small fruits” is expressed phenotypically in these hybrids.</td><td>1</td></tr>
<tr><td>2</td><td>Let 'S' be the symbol of the allele responsible for the phenotype "small fruit", dominant.
Let "l" be the symbol of the allele responsible for the phenotype "large fruit”, recessive.</td><td>0.5</td></tr>
<tr><td>3</td><td>Parent's phenotypes: ♂ [S] x ♀ [S]
Parent's genotypes: ♂ S//l x ♀ S//l
Gametes of parents: 50% S 50% l 50% S 50%l
Table of cross:
<table>
<tr><th>γ♂ / γ♀</th><th>50% S</th><th>50% l</th></tr>
<tr><td>50% S</td><td>25% S//S</td><td>25% S//l</td></tr>
<tr><td>50% l</td><td>25% S//l</td><td>25% l//l</td></tr>
</table>
Phenotypic Percentages:
75% Tomato plants with small fruits
25% Tomato plants with large fruits
Thus, the theoretical results verify the experimental ones.</td><td>2</td></tr>
<tr><td>4-1</td><td>The genotype of the tomato plant having large fruits is l//l, since it has a recessive phenotype and the recessive allele is only expressed in the homozygous state.
The genotype of the tomato plant having small fruits is S//l. Since it has a dominant phenotype, so it possesses the allele S. However, it gave 50% of the descendants having large fruits, a recessive phenotype that is only expressed in the homozygous state. Consequently, it also possesses the allele l.</td><td>1.25</td></tr>
<tr><td>4-2</td><td>Test cross</td><td>0.25</td></tr>
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