

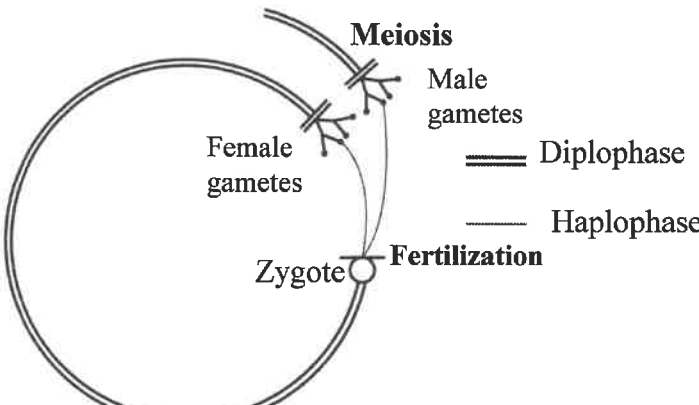
2h	مدة الإنجاز	علوم الحياة والأرض	المادة
3	المعامل	شعبة العلوم الرياضية (أ) (خيار إنجليزية)	الشعبة أو المسلك

### Section I : Knowledge Retrieval (5 pts)

Questions	Response elements	Scores
I	<p>Accept all correct answers from the following suggestions:</p> <p>- <b>Gametophyte</b> : * plant derived from a spore intended to produce gametes. * a life cycle generation that produces gametes.....(0.5 pt)</p> <p>- <b>Spore</b> : Generally haploid cell capable of developing into an individual that produces gametes.....(0.5 pt)</p>	1 pt
II	(1, c) - (2, a) - (3, c) - (4, a) ..... (0.5pt x4)	2 pts
III	(a; true ) ; ( b ; true ) ; ( c ; false ) ; ( d ; true ) .....(0.25pt x 4)	1 pt
IV	(1, c) - (2, c) - (3, a) - (4, b) ..... (0.25pt x4)	1 pt

### Section II: Scientific reasoning and communication in graphic and written modes (15 pts)

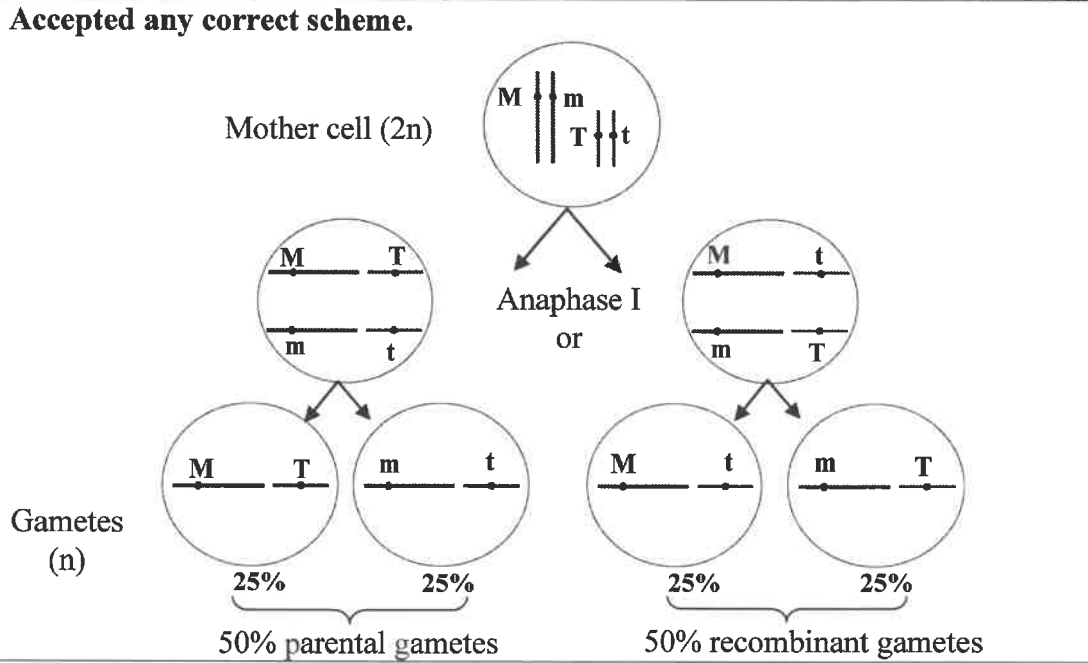
#### Exercise 1 : (2 pts)

Questions	Response elements	Scores
1	<p>- The chromosomal formula of the male gamete: <math>n= 19= 18A + X</math> or <math>n= 19= 18A + Y</math>.....(0.5 pt)</p> <p>- The chromosomal formula of the zygote: <math>2n=38=18AA + XY</math> or <math>2n= 38= 18AA + XX</math>.....(0.5 pt)</p>	1 pt
2	<p>- Chromosome cycle of the cat: .....(0.75 pt)</p> <div style="text-align: center;">  </div> <p>- Type of cycle: diplophasic.....(0.25 pt)</p>	1 pt

#### Exercise2: (4.75 pts)

Questions	Response elements	Scores
1	<p><b>First cross:</b></p> <p>- The F<sub>1</sub> generation is homogeneous: Mendel's first law is verified.....(0.25 pt)</p> <p>- The brown coat color allele is dominant (M) and the black coat color allele is recessive (m), the plain marking allele is dominant (T) and the spotted marking</p>	1pt

allele is recessive (t).....(0.25 pt)  
**Second cross:**  
 The F2 generation obtained is composed of four phenotypes:  
 - [M, T] with a percentage of  $134 / 233 = 57,52\% \rightarrow 9/16$ .  
 - [M, t] with a percentage of  $41 / 233 = 17,6\% \rightarrow 3/16$ .  
 - [m,T] with a percentage of  $44 / 233 = 18,88\% \rightarrow 3/16$ .  
 - [m, t] with a percentage of  $14 / 233 = 6\% \rightarrow 1/16$ ..... (0.25 pt)  
 So the two genes studied are independent ..... (0.25pt)



**The F<sub>2</sub> generation resulting from the crossing between the individuals of the F<sub>1</sub> generation.**

Phenotype : [M, T] x [M, T] (0.25 pt)  
 Genotype : M//m T//t x M//m T//t (0.25 pt)  
 Gametes : M/T/ ¼ ; M/ t/ ¼ x M/T/ ¼ ; M/t/ ¼ (0.25 pt)  
 m/ T/ ¼ ; m/ t/ ¼ m/ T/ ¼ ; m/ t/ ¼

Punnet square:.....(1 pt)

γ F <sub>1</sub>	M/ T/ ¼	M/ t/ ¼	m/ T/ ¼	m/ t/ ¼
γ F <sub>1</sub>	M//M T//T [M,T] 1/16	M//M T//t [M,T] 1/16	M//m T//T [M,T] 1/16	M//m T//t [M,T] 1/16
M/ t/ ¼	M//M T//t [M,T] 1/16	M//M t//t [M,t] 1/16	M//m T//t [M,T] 1/16	M//m t//t [M,t] 1/16
m/ T/ ¼	M//m T//T [M,T] 1/16	M//m T//t [M,T] 1/16	m//m T//T [m,T] 1/16	m//m T//t [m,T] 1/16
m/ t/ ¼	M//m T//t [M,T] 1/16	M//m t//t [M,t] 1/16	m//m T//t [m,T] 1/16	m//m t//t [m,t] 1/16

We obtain: [M, T] 9/16 ; [M, t] 3/16 ; [m, T] 3/16 ; [m,t] 1/16  
 The theoretical results are consistent with the experimental results.....(0.25 pt)

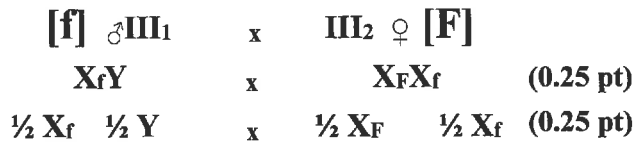
4	<p>Accept one of the following interpretations:</p> <p><b>1<sup>st</sup> interpretation:</b></p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;">Phenotype :</td> <td style="width:20%;">[M, t]</td> <td style="width:5%; text-align: center;">x</td> <td style="width:20%;">[m, t]</td> <td style="width:25%; text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Genotype :</td> <td>M//M t//t</td> <td style="text-align: center;">x</td> <td>m//m t//t</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Gametes :</td> <td>100% M/ t/</td> <td style="text-align: center;">x</td> <td>100% m/ t/</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Fertilization</td> <td colspan="2" style="text-align: center;">↓</td> <td>M//m t//t</td> <td style="text-align: right;">100% [M, t] (0.25 pt)</td> </tr> <tr> <td></td> <td colspan="4" style="text-align: center;">..... or.....</td> </tr> </table> <p><b>2<sup>nd</sup> interpretation:</b></p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;">Phenotype :</td> <td style="width:20%;">[M, t]</td> <td style="width:5%; text-align: center;">x</td> <td style="width:20%;">[M, t]</td> <td style="width:25%; text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Genotype :</td> <td>M//M t//t</td> <td style="text-align: center;">x</td> <td>M//M t//t</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Gametes :</td> <td>100% M/ t/</td> <td style="text-align: center;">x</td> <td>100% M/ t/</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Fertilization :</td> <td colspan="2" style="text-align: center;">↓</td> <td>M//M t//t</td> <td style="text-align: right;">100% [M, t] (0.25 pt)</td> </tr> <tr> <td></td> <td colspan="4" style="text-align: center;">..... or.....</td> </tr> </table> <p><b>3<sup>rd</sup> interpretation:</b></p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:30%;">Phenotype :</td> <td style="width:20%;">[M, t]</td> <td style="width:5%; text-align: center;">x</td> <td style="width:20%;">[M, t]</td> <td style="width:25%;"></td> </tr> <tr> <td>Genotype :</td> <td>M//M t//t</td> <td style="text-align: center;">x</td> <td>M//m t//t</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td>Gametes :</td> <td>100% M/ t/</td> <td style="text-align: center;">x</td> <td>50 % M/ t/ ; 50 % m/ t/</td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td></td> <td colspan="4" style="text-align: center;">↓</td> </tr> <tr> <td>Fertilization :</td> <td colspan="4" style="text-align: right;">50% M//M t//t + 50% M//m t//t = 100% [M, t] (0.25 pt)</td> </tr> </table>	Phenotype :	[M, t]	x	[m, t]	(0.25 pt)	Genotype :	M//M t//t	x	m//m t//t	(0.25 pt)	Gametes :	100% M/ t/	x	100% m/ t/	(0.25 pt)	Fertilization	↓		M//m t//t	100% [M, t] (0.25 pt)		..... or.....				Phenotype :	[M, t]	x	[M, t]	(0.25 pt)	Genotype :	M//M t//t	x	M//M t//t	(0.25 pt)	Gametes :	100% M/ t/	x	100% M/ t/	(0.25 pt)	Fertilization :	↓		M//M t//t	100% [M, t] (0.25 pt)		..... or.....				Phenotype :	[M, t]	x	[M, t]		Genotype :	M//M t//t	x	M//m t//t	(0.25 pt)	Gametes :	100% M/ t/	x	50 % M/ t/ ; 50 % m/ t/	(0.25 pt)		↓				Fertilization :	50% M//M t//t + 50% M//m t//t = 100% [M, t] (0.25 pt)				1 pt
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**Exercise3: (3.25 pts)**

Questions	Response elements	Scores																					
1	<p><b>Accept any logical response :</b></p> <p>a- - The allele responsible for the disease is recessive: individual III1 is sick and comes from two healthy parents.</p> <p><b>Accept all correct answers from the following suggestions:</b></p> <p>b- <b>- Sex linkage:</b></p> <p>* Not linked to the Y chromosome: individual III<sub>3</sub> is affected and comes from a healthy father..... (0.25 pt)</p> <p>* linked to the X chromosome: the disease is recessive, the male III<sub>3</sub> is sick and comes from a father II<sub>4</sub> who does not carry the morbid allele so he carries only one example of the morbid allele which is expressed because it is linked to X.. (0.25 pt)</p>	0.25 pt																					
2	<p>* The probability that the couple III<sub>3</sub> and III<sub>4</sub> gives birth to a sick individual:</p> <table style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="width:30%; text-align: center;">[f] ♂III<sub>3</sub></td> <td style="width:5%; text-align: center;">x</td> <td style="width:30%; text-align: center;">III<sub>4</sub> ♀ [F]</td> <td style="width:35%;"></td> </tr> <tr> <td style="text-align: center;">X<sub>f</sub>Y</td> <td style="text-align: center;">x</td> <td style="text-align: center;">X<sub>F</sub>X<sub>F</sub></td> <td style="text-align: right;">(0.25 pt)</td> </tr> <tr> <td style="text-align: center;">½ X<sub>f</sub> ½ Y</td> <td style="text-align: center;">x</td> <td style="text-align: center;">1 X<sub>F</sub></td> <td style="text-align: right;">(0.25 pt)</td> </tr> </table> <p>Punnet square:.....(0.25 pt)</p> <table border="1" style="width:100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="width:30%; text-align: center;">γ ♂</td> <td style="width:35%; text-align: center;">½ X<sub>f</sub></td> <td style="width:35%; text-align: center;">½ Y</td> </tr> <tr> <td style="width:30%; text-align: center;">γ ♀</td> <td style="width:35%; text-align: center;">1 X<sub>F</sub></td> <td style="width:35%; text-align: center;">X<sub>F</sub>X<sub>F</sub> ½ [F] ♀</td> </tr> <tr> <td style="width:30%; text-align: center;">1 X<sub>F</sub></td> <td style="width:35%; text-align: center;">X<sub>F</sub>Y ½ [F] ♂</td> <td style="width:35%;"></td> </tr> </table> <p>The probability of having a sick individual is zero.....(0.25pt)</p>	[f] ♂III <sub>3</sub>	x	III <sub>4</sub> ♀ [F]		X <sub>f</sub> Y	x	X <sub>F</sub> X <sub>F</sub>	(0.25 pt)	½ X <sub>f</sub> ½ Y	x	1 X <sub>F</sub>	(0.25 pt)	γ ♂	½ X <sub>f</sub>	½ Y	γ ♀	1 X <sub>F</sub>	X <sub>F</sub> X <sub>F</sub> ½ [F] ♀	1 X <sub>F</sub>	X <sub>F</sub> Y ½ [F] ♂		1 pt
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1 X <sub>F</sub>	X <sub>F</sub> Y ½ [F] ♂																						

3

\* The consanguineous marriage between III<sub>1</sub> and III<sub>2</sub>:



Punnet square:.....(0.5 pt)

	$\gamma \text{ ♀}$	$\frac{1}{2} X_F$	$\frac{1}{2} X_f$
$\gamma \text{ ♂}$		$X_F X_f \quad 1/4 [F] \text{ ♀}$	$X_f X_f \quad 1/4 [f] \text{ ♀}$
	$\frac{1}{2} Y$	$X_F Y \quad 1/4 [F] \text{ ♂}$	$X_f Y \quad 1/4 [f] \text{ ♂}$

1.5 pt

The probability that the couple III<sub>1</sub> and III<sub>2</sub> gives a sick individual is 1/2. So the consanguineous marriage increases the probability of the appearance of the disease ..... (0,5 pt)

**Exercise 4: (5 pts)**

Questions	Response elements	Scores
1	<p><b>a-</b> Realization of a histogram and a correct frequency polygon according to the scale proposed in the exercise.</p> <div style="text-align: center;"> </div>	

2	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th><math>x_i</math></th> <th><math>f_i</math></th> <th><math>f_i x_i</math></th> <th><math>x_i - \bar{X}</math></th> <th><math>(x_i - \bar{X})^2</math></th> <th><math>f_i (x_i - \bar{X})^2</math></th> </tr> </thead> <tbody> <tr><td>22,5</td><td>2</td><td>45</td><td>-27,15</td><td>737,1225</td><td>1474,245</td></tr> <tr><td>27,5</td><td>23</td><td>632,5</td><td>-22,15</td><td>490,6225</td><td>11284,3175</td></tr> <tr><td>32,5</td><td>60</td><td>1950</td><td>-17,15</td><td>294,1225</td><td>17647,35</td></tr> <tr><td>37,5</td><td>85</td><td>3187,5</td><td>-12,15</td><td>147,6225</td><td>12547,9125</td></tr> <tr><td>42,5</td><td>130</td><td>5525</td><td>-7,15</td><td>51,1225</td><td>6645,925</td></tr> <tr><td>47,5</td><td>180</td><td>8550</td><td>-2,15</td><td>4,6225</td><td>832,05</td></tr> <tr><td>52,5</td><td>140</td><td>7350</td><td>2,85</td><td>8,1225</td><td>1137,15</td></tr> <tr><td>57,5</td><td>120</td><td>6900</td><td>7,85</td><td>61,6225</td><td>7394,7</td></tr> <tr><td>62,5</td><td>80</td><td>5000</td><td>12,85</td><td>165,1225</td><td>13209,8</td></tr> <tr><td>67,5</td><td>55</td><td>3712,5</td><td>17,85</td><td>318,6225</td><td>17524,2375</td></tr> <tr><td>72,5</td><td>20</td><td>1450</td><td>22,85</td><td>522,1225</td><td>10442,45</td></tr> <tr><td>77,5</td><td>5</td><td>387,5</td><td>27,85</td><td>775,6225</td><td>3878,1125</td></tr> <tr><td>Totals</td><td>900</td><td>44690</td><td></td><td></td><td>104018,25</td></tr> </tbody> </table> <p>Correct application table for the calculation of statistical parameters..... (1.5pt)          Arithmetic mean : <math>\bar{X}=49.65</math> cm .....(0.25pt)          Standard deviation : <math>\sigma = 10.75</math> cm .....(0.25pt)</p>	$x_i$	$f_i$	$f_i x_i$	$x_i - \bar{X}$	$(x_i - \bar{X})^2$	$f_i (x_i - \bar{X})^2$	22,5	2	45	-27,15	737,1225	1474,245	27,5	23	632,5	-22,15	490,6225	11284,3175	32,5	60	1950	-17,15	294,1225	17647,35	37,5	85	3187,5	-12,15	147,6225	12547,9125	42,5	130	5525	-7,15	51,1225	6645,925	47,5	180	8550	-2,15	4,6225	832,05	52,5	140	7350	2,85	8,1225	1137,15	57,5	120	6900	7,85	61,6225	7394,7	62,5	80	5000	12,85	165,1225	13209,8	67,5	55	3712,5	17,85	318,6225	17524,2375	72,5	20	1450	22,85	522,1225	10442,45	77,5	5	387,5	27,85	775,6225	3878,1125	Totals	900	44690			104018,25	2 pts
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3	<p><b>Comparison:</b></p> <ul style="list-style-type: none"> <li>- The frequency polygon is unimodal for both populations.</li> <li>The mode of the P<sub>2</sub> population is higher than that of the P<sub>1</sub> population.....(0.25pt)</li> <li>- The dispersion of the length of the floral stem in the P<sub>1</sub> population ranges between 22.5 cm and 77.5 cm, it is more spread out than that of the P<sub>2</sub> population which varies between 42.5 cm and 87.5 cm.....(0.25pt)</li> </ul> <p><b>Inference:</b></p> <ul style="list-style-type: none"> <li>- The selection is efficient, the P<sub>1</sub> population is heterogeneous. Therefore, the hypothesis is refuted .....(0.5 pt) (Accept the correct hypothesis for the second proposition)</li> </ul>	1 pt																																																																																				
4	<p><b>Deduction:</b> Selection is inefficient .....(0.25pt)</p> <p><b>Justification:</b></p> <p>The parameters of populations P<sub>2</sub> and P<sub>3</sub> are close: mode= 67.5 cm and dispersion of flower stem length between 40 cm and 90 cm.....(0.5pt)</p>	0.75 pt																																																																																				

الصفحة 1	<b>الامتحان الوطني الموحد للبكالوريا</b> المسالك الدولية الدورة الاستدراكية 2021 - عناصر الإجابة -	<b>المملكة المغربية</b> وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي المركز الوطني للتقويم والامتحانات
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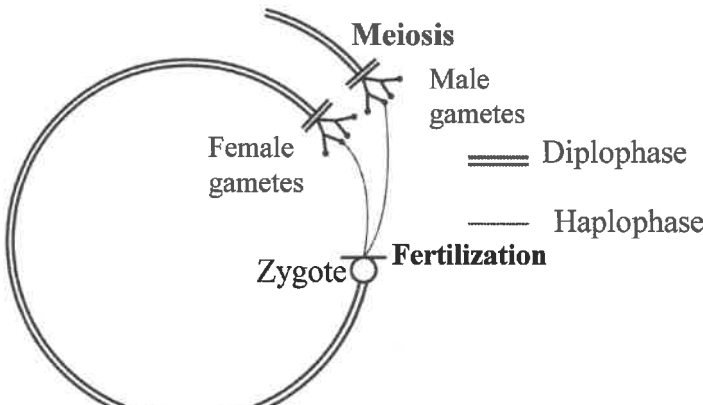
2h	مدة الإنجاز	<b>علوم الحياة والأرض</b>	المادة
3	المعامل	شعبة العلوم الرياضية (أ) (خيار إنجليزية)	الشعبة أو المسلك

### Section I : Knowledge Retrieval (5 pts)

Questions	Response elements	Scores
I	<b>Accept all correct answers from the following suggestions:</b> - <b>Gametophyte</b> : * plant derived from a spore intended to produce gametes. * a life cycle generation that produces gametes.....(0.5 pt) - <b>Spore</b> : Generally haploid cell capable of developing into an individual that produces gametes.....(0.5 pt)	1 pt
II	(1, c) - (2, a) - (3, c) - (4, a) ..... (0.5pt x4)	2 pts
III	(a; true ) ; ( b ; true ) ; ( c ; false ) ; ( d ; true ) .....(0.25pt x 4)	1 pt
IV	(1, c) - (2, c) - (3, a) - (4, b) ..... (0.25pt x4)	1 pt

### Section II: Scientific reasoning and communication in graphic and written modes (15 pts)

#### Exercise 1 : (2 pts)

Questions	Response elements	Scores
1	- The chromosomal formula of the male gamete: $n=19=18A+X$ or $n=19=18A+Y$ .....(0.5 pt) - The chromosomal formula of the zygote: $2n=38=18AA+XY$ or $2n=38=18AA+XX$ .....(0.5 pt)	1 pt
2	- Chromosome cycle of the cat: .....(0.75 pt)  - Type of cycle: diplophasic.....(0.25 pt)	1 pt

#### Exercise2: (4.75 pts)

Questions	Response elements	Scores
1	<b>First cross:</b> - The F <sub>1</sub> generation is homogeneous: Mendel's first law is verified.....(0.25 pt) - The brown coat color allele is dominant (M) and the black coat color allele is recessive (m), the plain marking allele is dominant (T) and the spotted marking	1pt