الأطر المرجعية المكيفة الخاصة بالامتحان الوطني الموحد لنيل شهادة البكالوريا – دورة 2020 –
المسالك الدولية : خيار أنجليزية

الإطار المرجعي لمادة علوم الحياة والأرض

شعبة العلوم الرياضية

مسلك العلوم الرياضية " أ"

I. Areas of assessment:

1. Specific competencies covered by the evaluation

According to the pedagogical guidelines and the specific teaching programmes for Life and Earth Sciences at the secondary school, the target competences for Mathematical Science stream 'A' enable the learner to:

- **Acquire** knowledge of the transmission of genetic information through sexual reproduction and human genetics, **use** this knowledge to solve problems related to the transmission of hereditary characteristics/traits and be aware of hereditary diseases so as to take the necessary precautions against diseases;
- **Acquire basic knowledge** of genetic variation with the aim of understanding the importance of selection to improve the quality and profitability of agricultural production and its impact on economic production;
- **Adopt a scientific approach** suitable to address issues related to genetics, genetic and variation;
- **Use various modes of expression** (oral, written and graphic) to communicate and present phenomena related to genetics and variation;

2. Content areas areas covered by the evaluation

2.1. First content area: Transmission of genetic information through sexual reproduction and human genetics.

This area allows the learner to acquire knowledge of the transmission of genetic information through sexual reproduction and the statistical laws of the transmission of hereditary characteristics/traits in diploid organisms and human genetics.

The study of the transmission of genetic information through sexual reproduction consists of highlighting the role of meiosis and fertilisation in the karyotype stability, and in the recombination and genetic diversity. To achieve that, it is necessary to:

- Define meiosis, identify its different phases and show its role in recombination of alleles (genetic recombination of homologous chromosomes by linkage/crossing-over and chromosomes independent assortment) and therefore deduce the genetic diversity of gametes;
- Define fertilisation and show its role in genetic recombination and in genetic diversity of individuals within the same species;
- Deal with examples of development cycles in order to show the role of alternation of fertilisation and meiosis in karyotype stability in individuals within the same species from one generation to the next.

The study of Mendel's laws explaining the transmission of hereditary characteristics/traits in diploid organisms consists of:

- Formulating the notions of genotype, pure lineage / purebreds (wild type and mutant) and hybridisation;

- Learning Mendel's laws and their exceptions through the study of examples of autosomal monohybridism/monohybrid inheritance (dominance and codominance, lethal gene) and sex-linked gene, and dihybridism/dihybrid inheritance (independent and linked genes);
- Showing the role of linkage/crossing-over in genetic diversity of generations and in the construction of gene maps.

The study of human genetics consists of:

- Knowing the methods and the means of studying the transmission of hereditary characteristics/traits in humans (pedigree, karyotypes) and studying the modes of transmission of some hereditary autosomal and sex-linked diseases using pedigree, karyotypes, and gene detection techniques;
- Highlighting certain chromosomal abnormalities and their consequences by using karyotypes.

2.2. Second content area: Genetic variation

The aim of this content area is to acquire knowledge related to the quantitative study of variation.

Quantitative study of genetic variation consists of:

- Studying the quantitative characteristics/traits variation across generations (continuous and discontinuous variation) in individuals within a given population by applying principles and statistical techniques, and thus determining the characteristics of continuous and discontinuous variation of hereditary characteristics based on the study of various examples ;
- Using graphical representation of continuous and discontinuous variation in order to show these characteristics/traits;
- Using quantitative study to determine the characteristics and peculiarities of a population (homogeneity or heterogeneity, pure lineage/ purebreds), and constructing the notion of artificial selection by showing its effectiveness in the selection of purebreds.

II - Organization of notional and methodological areas covered by the evaluation

1.Table of Contents:

Area 1 : Transmission of genetic information through sexual reproduction and Human genetics. (Coverage : from 70% to 75%)		
Sub-areas	**Content**	**Basic objectives (notional / methodological)**
1.1. Transmission of genetic information through sexual reproduction	• Meiosis phases; • Karyotypes of diploid species; • Role of meiosis and fertilisation in allelic recombination/ recombination of alleles (genetic recombination of homologous chromosomes by linkage/crossing-over and chromosomes independent assortment) and in karyotype stability across generations; • Development and chromosome cycles.	• **Describe** and **recognise** the meiosis phases; • **Analyse** karyotypes of diploid species; • **Deduce** through exploitation of data based on observation and experimentation: o **The** role of meiosis and fertilisation in allelic recombination and in the karyotype stability in the same species from a generation to the next; o The role of meiosis and fertilisation in genetic diversity; • **Draw** diagrams in relation to the meiosis phases, development and chromosome cycles.
1.2. Mendel's laws of the transmission of hereditary characteristics /traits in diploid organisms	• Mendel's laws of the transmission of hereditary characteristics/traits; • Monohybridism/monohybrid cross and dihybridism/dihybrid cross; • Pure lineage and wild type, homozygosity and heterozygosity, hybridisation, test cross, back cross; • Punnett squares; • Autosomal heredity (independent of sex) and sex-linked heredity; • Dominance, codominance and lethal gene. • Unlinked genes (genes of independent assortment) and linked genes; • Linkage/crossing-over, genetic recombination of homologous chromosomes by linkage/crossing-over and genetic diversity;	• **Analyse** and **interpret** the results of the transmission of a couple of alleles from the study of a specific example (in cases of a sex-linked gene and autosomal gene); • **Analyse** and **interpret** the results of the transmission of two couples of alleles from the study of a specific example (in cases of two unlinked genes and two linked genes); • **Draw a diagram** of genetic recombination of homologous chromosomes by linkage/crossing-over and independent assortment of homologous chromosomes, according to the example studied; • **Calculate** the distance between linked genes and **draw** a gene map/gene mapping.

	• Gene maps.	

1.3. Human genetics	• Notions of pedigree and karyotype. • Hereditary autosomal diseases. • Hereditary sex-linked diseases. • Chromosomal abnormalities and their consequences. • Chromosomal interpretation of hereditary diseases.	• **Analyse, interpret** and **explain** pedigree and karyotype data by inferring/deducing the mode of transmission of a gene in the case of: o Hereditary autosomal diseases ; o Hereditary sex-linked diseases; • **Analyse, interpret /explain** the chromosomal abnormalities by drawing appropriate diagrams; • **Give opinion** on the prenatal diagnosis of chromosomal abnormalities based on **data exploitation.**
Area 2 : Genetic variation **Coverage : from 20% to 30%**		
Sub-areas	**Content**	**Basic objectives (notional / methodological)**
Quantitative study of genetic variation	• Continuous and discontinuous variation of hereditary characteristics/traits; • Homogeneous and heterogeneous population ; • Position and dispersion parameters and their statistical significance; • Notion of pure lineage/purebreds (effective and ineffective selection). • Artificial selection.	• **Determine** the distinct characteristics of the continuous and discontinuous variation of hereditary characteristics/traits based on the study of examples; • **Use graphs to represent** the continuous and the discontinuous variations; • **Calculate** position and dispersion parameters and **deduce** their statistical significance; • **Deduce/conclude** the role of artificial selection in the improvement of agricultural productivity.

2. Skills Table

Skills areas	Skills	Weighting in (%)
Knowledge Retrieval.	This section, knowledge retrieval , aims to assess the degree of mastery of content using the following: • Multiple Choice Questions (MCQ). • True/false statements. • Matching. • Classification/seriation/rearranging. • Short-answer questions (giving definitions, labeling a diagram or a graph, and know theories, laws, scientific terms, facts, signs, etc.).	**25%**
Scientific Reasoning and Communication in graphic and written modes.	This Section, **scientific reasoning and communication in graphic and written modes, aims** to assess the degree of mastery of skills and competencies: • **Determine** and **formulate** a scientific problem; • **Use** background knowledge, **select** and **organise** information in relation to the subject of study; • **Link** information with acquired knowledge to resolve a scientific problem; • **Make/formulate** a hypothesis in relation to a scientific problem; • **Use knowledge** to solve a scientific problem or to **explain** the phenomena under study; • **Suggest** appropriate tools to **test** hypotheses; • **Describe** and **analyse** scientific data; • **Compare** and **explain/interpret** results; • **Infer** and **generalise the results**; • **Use** principles, laws, models to **explain/interpret** scientific phenomena and data; • **Conduct a synthesis** of information and data and turn it into a text or a diagram; • **Give** an opinion and support it with arguments. • **Present** a structure or biological and geological phenomena using a diagram. • **Turn** numerical data into a chart, a graph or a text. • **Draw** a functional diagram. • **Achieve/realise** a synthetic flowchart.	**75%**