I.B. Middle Years Programme

Course outline: Science: Biology, Chemistry, & Physics

Years 10 & 11

2010-2012

Aims: the aims of this course are to

1. Provide, through well-designed studies of experimental and practical science, a worthwhile educational experience for all students, whether or not they go on to study science beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge

- to become confident citizens in a technological world, to take or develop an informed interest in matters of scientific import;
- to recognize the usefulness, and limitations, of the scientific method and to appreciate its applicability in other disciplines and in everyday life; and
- to be suitably prepared for studies beyond the MYP level in pure sciences, in applied sciences, or in science-dependent vocational courses.
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2. Develop abilities and skills that
   - are relevant to the study and practice of Biology, Chemistry, and Physics;
   - are useful in everyday life;
   - encourage safe practice; and
   - encourage effective communication.
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3. Develop attitudes relevant to Biology, Chemistry, and Physics such as
   - concern for accuracy and precision;
   - objectivity;
   - integrity;
   - inquiry;
   - initiative; and
   - inventiveness.

4. Stimulate interest in, and care for, the environment.

5. Promote an awareness that
   - scientific theories and methods have developed, and continue to develop, as a result of co-operative activities of groups and individuals;
   - the study and practice of science are subject to social, economic, technological, ethical, and cultural influences and limitations;
   - the applications of science may be both beneficial and detrimental to the individual, the community, and the environment; and
   - science transcends national boundaries and that the language of science, correctly and rigorously applied, is universal.

Objectives to be achieved by the end of Year 11: the students should be able to:

. Demonstrate knowledge and understanding in relation to
- scientific phenomena, facts, laws, definitions, concepts, and theories;
- scientific vocabulary, terminology, and conventions (including symbols, quantities, and units);
- scientific instruments and apparatus, including techniques of operation and aspects of safety;
- scientific quantities and their determination; and
- scientific and technological applications with their social, economic, and environmental impacts.

2. Use words or other written forms of presentation to
- locate, select, organize, and present information from a variety of sources;
- translate information from one form to another;
- manipulate numerical and other data;
- use information to identify patterns, report trends, and draw inferences;
- present reasoned explanations for phenomena, patterns, and relationships;
- make predictions and hypotheses; and
- solve problems, including some of a quantitative nature.

3. Development experimental skills in order to
- use techniques, apparatus, and materials (including following a sequence of instructions where appropriate) to conduct activities;
- make and record observations, measurements, and estimates;
- interpret and evaluate experimental observations and data; and
- plan and carry out investigations, evaluate methods, and suggest possible improvements (including the selection of techniques, apparatus, and materials).

Internationalism:

The Sciences course contributes to the development of intercultural awareness by providing opportunities for students to explore scientific issues locally and globally. Addressing the global dimension of science implies dealing with global issues such as sustainability, interdependence, diversity, equity, etc., with the aim of developing attitudes of global citizenship.

Dealing with the global dimension of science provides students with the opportunity to develop their understanding of how science and society are interrelated and how social, economic, political, environmental, cultural, and ethical factors are interdependent. Encouraging students to explore issues critically from a global and multicultural perspective can foster the development of attitudes and values such as tolerance, respect, and empathy. Moreover, students will have the opportunity to reflect upon their roles and responsibilities in their community and in the wider world.

The opportunity to develop intercultural awareness through science can only be fully achieved in conjunction with the other subjects and the areas of interaction. Local and global issues from similar and contrasting cultures to our own will be explored in developing and implementing the Sciences course.

Addressing the Areas of Interaction in the Sciences: Hockerill MYP students will, at various points during the course, participate in activities that:

Approaches to Learning:

- Develop the following skills and attitudes: knowledge acquisition, application of knowledge, observation, information-processing and organizational, communication, scientific inquiry, analyzing, integrating and summarizing, evaluation, collaboration, responsibility, integrity, and reflection (metacognition).

Community and Service:

- Investigate scientific issues and their impact in the local community and/or the global society.
- Research service and aid initiatives in school, local, regional, and global communities.
- Promote awareness campaigns of environmental and health initiatives in the school or local community.
- Organize individual and group responses to community needs.
- Reflect on topics studied and services undertaken.

Human Ingenuity

- Develop an understanding of the evolution of scientific ideas and the rigor of scientific thought.
- Evaluate the social and ethical impact of scientific and technological developments.
- Develop an awareness of the tentative nature of science and ability to tolerate scientific uncertainties.
- Appreciate the nature of scientific inquiry and real-life scientific endeavour.
- Clarify misconceptions about the universal approach of the scientific method unravelling alternative approaches used by scientists in the real world.

Environment:

- Investigate the impact of human intervention on natural environments in areas such as climate change, species loss, deforestation, overpopulation, pollution of air and water, and diminishing of natural resources.
- Explore the interdependence of human conditions (activities and actions) and the environment, its resources, and its sustainability for future generations.
- Discuss how social, economic, and political dimensions affect actions and decisions about issues of environmental importance.
- Explore how human activity and exploitation of natural resources play a role in the sustainability of the natural capital.
- Develop plans to address a local environmental problem and to help maintain an environmental balance.
- Evaluate the effectiveness of actions to protect the environment in local or global contexts.

Health and Social Education:

- Research malnutrition in different cultural and economic settings – from eating disorders to hunger and famine.
- Investigate how society and peer pressure can endanger health, including aspects such as diet, alcohol, tobacco, and drugs.
- Research health and social issues in different parts of the world, reflecting on how they compare and contrast.
- Discuss the advantages and disadvantages of biotechnology and genetic engineering goods in any of the following areas – pharmaceuticals, agricultural, environmental, or medical treatment.
- Discuss social, cultural, and economic ramifications of scientific developments related to health such as in vitro fertilization, cloning, and genetic engineering.

- Devise health and social awareness campaigns within the school and local community based on students' research.

Subject-Specific Assessment Criteria:
Criterion A – One World
Maximum 6

Students should understand the interdependence of science and society. Students are expected to discuss how science is applied and used to solve specific problems in life and society. Students should be given the opportunity to explore local and global scientific issues and evaluate the interaction between science and scientific developments with social, economic, political, environmental, cultural, and ethical factors.

Level of Achievement	**Descriptor**
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student **describes** how science is applied to addressing a specific local or global issue. The student **states some** of the benefits **or** limitations of science in addressing the issue.
3-4	The student **describes** how science is applied to addressing a specific local or global issue. The student **describes some** of the benefits **or** limitations of science in addressing the issue. The student **describes** how science and its applications interact with at least **one** of the following factors: social, economic, political, environmental, cultural, and ethical.
5-6	The student **explains** how science is applied to addressing a specific local or global issue. The student **explains some** of the benefits **and** limitations of science in solving the issue. The student **discusses** how science and its applications interact with **some** of the following factors: social, economic, political, environmental, cultural, and ethical.

Criterion B – Communication in Science
Maximum 6

Students should be able to demonstrate understanding when communicating scientific information. Students should use appropriate scientific language, a range of communication modes, and the most appropriate communication format.

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student **attempts** to communicate scientific information using **some scientific language**. The student presents some of the information in an appropriate form using some symbolic or visual representation when appropriate. The student attempts to acknowledge sources of information but this is **inaccurate.**
3-4	The student communicates scientific information using **scientific language**. The student presents most of the information appropriately using symbolic and/or visual representation according to the task. The student acknowledges sources of information **with occasional errors.**
5-6	The student communicates scientific information **effectively** using **scientific language correctly**. The student presents all the information appropriately using symbolic and/or visual representation accurately according to the task. The student acknowledges sources of information **appropriately.**

Criterion C – Knowledge and Understanding of Science
Maximum 6

Students should show their understanding of the main scientific ideas and concepts of science by applying these to solve problems in familiar and unfamiliar situations. Students should develop critical-thinking skills to analyze and evaluate scientific information.

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student **recalls** some scientific ideas and concepts and applies these to solve **simple problems.**
3-4	The student **explains** scientific ideas and concepts and applies scientific understanding to solve **problems in familiar situations.** The student **analyses** scientific information by identifying parts, relationships or causes. The student provides an **explanation** that shows understanding.
5-6	The student explains scientific ideas and concepts and applies scientific understanding to solve **problems in familiar and unfamiliar situations.** The student **analyzes** and evaluates scientific information by making **scientifically supported judgments** about the information, the validity of the ideas or the quality of the work.

Criterion D – Scientific Enquiry
Maximum 6

Students are expected to design and carry out scientific investigations independently. Students should be able to (i) state a problem that can be tested by an investigation; (ii) formulate a suitable hypothesis; (iii) identify and manipulate variables; (iv) plan an appropriate investigation including the method and materials; and (v) evaluate the method.

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student **attempts to define** the purpose of the investigation and makes references to variables but these are **incomplete** or not fully developed. The method suggested is **partially complete**. The **evaluation** of the method **is either absent or incomplete**.
3-4	The student **defines** the purpose of the investigation and provides an **explanation/prediction** but this is not fully developed. The student acknowledges **some of the variables** involved and describes how to manipulate them. The method suggested is **complete** and includes appropriate materials/equipment. The **evaluation** of the method **is partially developed.**
5-6	The student **defines** the purpose of the investigation, **formulates a testable hypothesis** and **explains** the hypothesis using scientific reasoning. The student identifies the relevant variables and **explains how to manipulate** them. The student **evaluates** the method commenting on its **reliability** and/or **validity**. The student suggests improvements to the method and makes suggestions for further inquiry when relevant

Criterion E – Processing Data
Maximum 6

Processing data refers to enabling students to organize and process data. Students should be able to organize and transform data by numerical calculations into diagrammatic form (tables, graphs, and charts) and draw and explain appropriate conclusions.

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student **organizes** and presents data using **simple numerical or diagrammatic forms** and draws an **obvious conclusion.**
3-4	The student organizes and **transforms** data into **numerical and diagrammatic forms** and presents it using **appropriate communication modes**. The student draws a **conclusion consistent with the data.**
5-6	The student organizes and transforms data into numerical and diagrammatic forms and presents it logically and clearly, using appropriate communication modes. The student **explains trends, patterns or relationships** in the data, comments on the reliability of the data, draws **a clear conclusion** based on the correct interpretation of the data, and explains it using **scientific reasoning.**

Criterion F – Attitudes in Science
Maximum 6

This criterion refers to encouraging students' attitudes of safety, respect, and collaboration. Students are expected to carry out scientific investigations using materials and techniques skilfully and safely, show respect for the living and non-living environment, and work effectively as a member of a team by collaborating, acknowledging, and respecting the views of others as well as ensuring a safe working environment.

Level of Achievement	**Descriptor**
0	The student does not reach a standard described by any of the descriptors given below.
1-2	The student requires **guidance** and **supervision** when using laboratory equipment. The student can work safely and cooperate with others but may **need reminders**.
3-4	The student uses most equipment competently but might require occasional guidance; on most occasions **pays attention to safety** and works responsibly with the living and non-living environment. The student **generally cooperates** well with other students.
5-6	The student **works largely independently;** uses equipment with precision and skill; **pays close attention to safety** and deals responsibly with the living and non-living environment. The student consistently **works effectively as part of a team**, collaborating with others and respecting their views.

Content
The content of the MYP Science courses at Hockerill are based on the Edexcel GCSE scheme of work. Science GCSEs changed on a nationwide basis from September 2006. The emphasis changed from content driven courses to ones where application and processes are more important, with the aim of making all students more scientifically literate in our ever more technological world.

Students must select from one of the following:

Option 1- Single Sciences (Biology, Chemistry and Physics), leading to three GCSEs. This option is only available to students who started the GCSE course in Year 9.

Option 2 – GCSE Science and GCSE Additional Science (together the equivalent of the old 'Double Science') leading to two GCSEs.

Recommended Entry

Students who intend to study any Sciences at IB Higher level or at A Level could choose Option 1 or Option 2. Both are designed for access to these courses. However Option 1 does give a better 'head start' in all post GCSE Science courses. It does involve a considerably greater workload than Option 2 as the students have to cover an extra 50% of modules in the same time allocation as Option 1. Option 2 is regarded as normal entry to post-16 Science courses and is open to all students entering Year 10.

Option 1 entry will be at the discretion of the Science faculty and based on MYP performance up until the November of Year 9. Students may be required to attend extra lunchtime or after College sessions to complete the course.

The Modules are as follows:-

GCSE SCIENCE – started in Year 9 and continuing into Year 10		
Biology	Chemistry	Physics
Environment	Patterns in Properties	Producing and measuring Electricity
Genes	Making Changes	You're in Charge
Electrical and Chemical signals	There's one earth	Now You See it, Now You Don't
Use, Misuse and Abuse	Designer Products	Space and its Mysteries
GCSE ADDITIONAL SCIENCE – Mainly Year 11 (option 2) and years 10 and 11(option 1)		
Inside Living Cells	Synthesis	As Fast as you Can!
Divide and Develop	In Your Element	Roller-Coasters and Relativity
Energy Flow	Chemical Structures	Putting Radiation to Use
Interdependence	How Fast? How Furious?	Power of the Atom
GCSE Biology, Chemistry and Physics – (option 1 only) – Year 11(longer modules)		
Biotechnology	Chemical Detection	Particles in Action
Behaviour in Humans and Other Animals	Chemistry Working for Us	Medical Physics

Official Assessment required for GCSE certification.

GCSE SCIENCE

The total assessment is:
60% **external** assessment based on six tiered multiple-choice exams available in November, March and June, and
40% **internal** assessment, made up of 10% teacher assessment and 30% on assessment activities provided by the examination board.
The dates for the module examinations will be published in the College calendar. Prior to the examination students are issued with a statement of entry by the Examinations Officer. These must be checked carefully to ensure that they have been entered for the correct examination.

GCSE ADDITIONAL SCIENCE

The assessment is similar to GCSE Science. However there are three multiple-choice examinations and three structured examinations (longer answers), again in November, March or June

GCSE BIOLOGY, GCSE CHEMISTRY AND GCSE PHYSICS

In addition to all of the Science and Additional Science examinations, each Science has one structured examination paper available in the June of Year 11 for each of the three Sciences.

Career Opportunities

A large number of careers specify Science as a requirement, including careers in the 'pure' sciences, Medicine, Dentistry, Veterinary Science, Engineering, Armed Forces, Computer Technology and many more. Areas such as the Law and Personnel and Business Management like to recruit candidates who have had some scientific experience and can approach problems in a methodical and logical manner.

At post-16 IB Higher level Sciences and A levels all open up a whole range of specialist careers as well as the possibility of taking a Science related degree.

For further advice please ask any member of the Science Faculty:

Mr. S Chalmers (Head of Faculty)
Mr. D Parsons (Second in Faculty and Head of Physics)
Mr. G Pollard (Head of Chemistry)
Dr. D Letten
Mr. S Jacobs
Mr. J Catchpole
Mr. C. Jones
Mr. C. Wright
Mr. E Vine
Miss K. van Santen