AN ROINN OIDEACHAIS

THE JUNIOR CERTIFICATE

SCIENCE SYLLABUS

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THE JUNIOR CERTIFICATE

AIMS AND PRINCIPLES

1. The general aim of education is to contribute towards the development of all aspects of the individual, including aesthetic, creative, critical, cultural, emotional, intellectual, moral, physical, political, social and spiritual development, for personal and family life, for working life, for living in the community and for leisure.

2. The Junior Certificate programme aims to

- reinforce and further develop in the young person the knowledge, understanding, skills and competencies acquired at primary level;
- extend and deepen the range and quality of the young person's educational experience in terms of knowledge, understanding, skills and competencies;
- develop the young person's personal and social confidence, initiative and competence through a broad, well-balanced general education;
- prepare the young person for the requirements of further programmes of study, of employment or of life outside full-time education;
- contribute to the moral and spiritual development of the young person and to develop a tolerance and respect for the values and beliefs of others;
- prepare the young person for the responsibilities of citizenship in the national context and in the context of the wider European Community.

3. The Junior Certificate programme is based on the following principles:

- breadth and balance: in the final phase of compulsory schooling, every young person should have a wide range of educational experiences. Particular attention must be given to reinforcing and developing the skills of numeracy, literacy and oracy. Particular emphasis should be given to social and environmental education, science and technology and modern languages.

- relevance: curriculum provision should address the immediate and prospective needs of the young person, in the context of the cultural, economic and social environment.

- quality: every young person should be challenged to achieve the highest possible standards of excellence, with due regard to different aptitudes and abilities and to international comparisons.

The curriculum should provide a wide range of educational experiences within a supportive and formative environment. It should draw on the aesthetic and creative, the ethical, the linguistic, the mathematical, the physical, the scientific and technological, the social, environmental and political and the spiritual domains.

4. Each Junior Certificate syllabus is presented for implementation within the general curriculum context outlined above.

I INTRODUCTION

This course in Junior Cycle Science has been drawn up to cater for the entire range of student ability, aptitude and achievement. It replaces the former courses presented as Science (Syllabus A), Science (Syllabus E) and Rural Science within the former Intermediate and Day Vocational Certificate programmes.

The course has been designed as a **practical course**, with an emphasis on student experience of science as a practical activity. There should be an emphasis on the **thought process** of science as well as the knowledge content. Particular emphasis is laid on the **everyday applications** of science in the student's life and environment: these are the points of transference from school-based learning to general experience.

The **historical impact** of science on society should influence the teaching of this course. Changing perceptions of the world and the universe and changing relationships between humans and their environments have been greatly influenced by scientific research and development. These should be highlighted as they arise in the course of teaching. Opportunities of linking with and relating to other subject areas should also be availed of, e.g. History, Geography, Home Economics. This course should also contribute to Health Education and to other cross-curricular areas.

The increasingly important role of **technology in everyday** life is recognised throughout the course, most explicitly perhaps in the Applied Science section which specifically addresses significant areas of interface between science and technology.

I.1 The core

A key feature of this course is the concept of the **core** - the knowledge, skills, concepts and attitudes in Science deemed essential for all school leavers. The **core** is an integrated section and is presented as such. For clarity of presentation, the relevant sections of the core are presented once again along with the corresponding extension material required for Ordinary and Higher Levels.

I.2 Addressing the syllabus

The syllabus presentation does not imply any particular order of teaching. A wide range of approaches may be used (see Teacher Notes) including, for example -

- a thematic approach: for example, developing from the four themes set out in the **core** section
- an applications approach: using the Applied Science section as a basis for the entire course and covering aspects of science from other sections from this perspective

I.3 Local Studies

Suggested activities for Local Studies will be provided in the Teacher Notes. Criteria for selection, implementation and assessment of project work in this area will also be provided.

I.4 Teaching strategies

Teaching strategies should aim to promote the objectives listed. (Suggested strategies will be found in the accompanying Teacher Notes.) They should encourage experimental work - the student attempting to find the answer to a particular question - as well as practical work - the students following a set of instructions. (Suggested activities will be found in the Teacher Notes.)

I.5 Length of course

The course content is presented in considerable detail in order t indicate the depth of treatment required. As such it may appear to be longer then it is in fact. It is recommended that 240-270 hours be made available for Science in the three years of Junior Cycle. The balance of time allocation as between the different sections should be approximately equal.

II AIMS AND OBJECTIVES

II.1 Aims

The aims of education in Science at Junior Cycle are to provide students with

- an essential body of scientific knowledge appropriate to their age
- an understanding of
  - matter, its various forms and interactions
  - energy, its various forms, usage and potential
  - plants and animals
  - the human body
  - the earth and the universe
- an awareness of the potential use, misuse and limitations of science
- an appreciation of and respect for the environment including all forms of life
- the ability to observe and evaluate phenomena and processes
- an ability to form opinions and judgements based on evidence and experiment
- the practical, cognitive, affective and communication skills related to Science and appropriate to their age
- an awareness of the technological, industrial, social, historical and economic aspects of science and their applications to everyday life
- manipulative skills and manual dexterity, measurement and numeracy skills, procedural skills
- the confidence to develop skills in creativity, intuition, imagination, investigation and inventiveness
- the ability and confidence to apply scientific knowledge and skills

II.2 Objectives

II.2.1 Course objectives

the specific objectives of the course have been set out under headings Attitudes, Knowledge and Concepts, and Skills. Both teaching methodology and the assessment objectives should reflect these objectives.

II.2.2 Attitudes

The student will

- develop a sense of safety in the laboratory, at home, in the workplace and in the environment
- develop a sense of accuracy and of attention to detail
- develop an appreciation of the scientific method comprising the following stages:
  - defining a problem by observation (problem recognition)
  - hypothesis or prediction of what will happen if...
  - experimentation/testing
  - explanation of outcome through discussion, communication, recording (critical evaluation)
  - checking/verifying conclusions (drawing conclusions)
- develop a scientific interest in his/her self and an understanding of his/her body, its functions and the causes of its malfunctions

II.2.3 Knowledge/Concepts

The student will

- develop an understanding of the applications of certain natural phenomena
- develop an understanding of the nutritional needs of plants and animals and how they interact
- develop an understanding of matter, its various forms and interactions
- examine what energy is, its various forms, what it can do and the need for its economical use
- learn the place of the earth in the universe and be aware that it is the only known planet capable of sustaining life as we know it
- learn the concept of a valid experiment
- learn that the composition of materials around us affects our quality of life and how some of these materials can be synthesised and analysed
- learn the importance of water to life
- understand the composition of the atmosphere and its importance
- investigate the scientific principles underlying industries, local, national or international
- develop interactions on a scientific level with the local environment/community

II.2.4 Skills

The junior Science course should assist in the development of the following skills:

- Manipulative skills and manual dexterity
- Measurement and numeracy skills
- Procedural skills; the ability to follow instructions and to carry out the experiment
- Skills of observation
- The ability to obtain information from various sources
- Independent study; to include project work and practical investigation
- Use of the scientific method in problem-solving
- Logical thinking, inductive and deductive reasoning and generalisation
- Classification - i.e. pattern formation
- The identification of cause and effect
- The ability to record information accurately
- The ability to interpret data and to translate information from one form to another, including the use of symbols, charts, graphs etc.
- The ability to prepare reports, oral and written

III COURSE STRUCTURE

The course consists of two parts:

- the core - common H + O levels
- the extensions P, C, B, A/S, L/S

The core is concerned with the scientific knowledge, skills, concepts and attitudes essential for all school leavers in today's world. This is an essential component of the course at both Ordinary and Higher Levels. It is presented as an integrated element within the overall course.

Core material is also presented once more in four of the five sections of the syllabus: Local Studies has no specified core material. **All students irrespective of course level or of options taken will be required to study the entire range of material presented as the core.**

The extensions Five extensions are available:

- Physics
- Chemistry
- Biology
- Applied Science
- Local Studies

For an interim period the Local Studies option will be confined to those schools where Rural Science was taught for the Day Vocational (Group) Certificate.

IV LEVELS

At Ordinary Level students will select any three of the extensions.

At Higher Level students will take the Physics, Chemistry and Biology extensions and will select either the Applied Science or the Local Studies extension.

Students selecting the Applied Science extension will select any two units from that section.

V ASSESSMENT OBJECTIVES

The purpose of the assessment procedures will be to allow a student the opportunity to:

V.1 Demonstrate knowledge and comprehension of certain important principles, theories and facts relating to science and their application

V.2 Demonstrate awareness of the technological, industrial, social, historical and economic aspects of science and their applications to everyday life

V.3 Demonstrate the ability to devise and carry out experiments for particular purposes, selecting suitable apparatus and using it effectively and safely

V.4 Demonstrate the ability to follow instructions accurately for the safe conduct of an experiment

V.5 Demonstrate the ability to observe, measure, record results accurately and perform necessary calculations

V.6 Demonstrate the ability to draw conclusions from available data

V.7 Demonstrate the ability to obtain information from a variety of sources

V.8 Demonstrate the ability to translate information from one form to another

V.9 Demonstrate the ability to prepare accurate reports, oral and written

V.10 Demonstrate the ability to use data to recognise patterns, to deduce relationships and to form hypotheses

V.11 Demonstrate the ability to solve problems applying scientific concepts and methods

V.12 Demonstrate the ability to evaluate critically experimental design and results, being aware of and able to explain possible sources of error and uncertainty

(There will be a variety of modes of assessment, depending on options taken. It may not be possible to assess all the above objectives within each mode of assessment.)

VI COURSE CONTENT

Format of syllabus presentation

For clarity of presentation, the syllabus is divided into

(a) the core: an integrated section
(b) five extension sections: Physics, Chemistry, Biology, Applied Science and Local Studies

Within each extension section the appropriate core material is presented once more, in bold type. This is to facilitate cross-referencing. The extension material is presented below the relevant core material and is divided into Ordinary Level and Higher Level. The Higher Level course incorporates Ordinary Level material together with the specified Higher Level material.

THE CORE **Page**

Reference numbers are provided with each item in the core. This is to facilitate easy cross-reference to the extension-sections, where the relevant item from the core is repeated and built upon.

1. THE CORE

Introduction to Science

This section is intended to introduce students to Science as a subject. It will introduce them to the laboratory, to various pieces of apparatus, to practical work and to the need for safety at all times in the laboratory. Experimental work and the scientific method can be introduced in its simplest form. The need for accuracy, both in carrying out an experiment and in observing and reporting what happens should be stressed. Some fundamental concepts of science are introduced in this section.

Safety	There is a need for safety in the laboratory at all time. There is a need for a sense of responsibility for one's own safety and for that of others. There are rules of safety in the laboratory.
Introduction to apparatus	Various simple items (glassware etc.) have their particular uses. There are also more complex pieces of equipment such as microscopes with a very specific use.
Matter	Matter occupies space. It exists as solid, liquid or gas. These states can interchange, involving the gain or loss of heat.
Changes	Physical changes involve a substance changing form. Chemical changes involve a substance changing to another substance.
Living things	Living things have certain characteristics which distinguish them from non-living things.
Measurement	Length, mass and time are fundamental physical quantities. Their units of measurement follow the S.I. system. Rulers, callipers, opisometers, trundle wheels are used for measuring length. Area, volume, weight. All measurements are made to a certain degree of accuracy.

A. The human body

9.3 The human is an organism with a variety of systems to carry out a range of functions. Each system has a particular structure which enables it to carry out its functions.

Nutrition
The digestive system takes in food for the nutrition of the body. The food is digested by the system and is then distributed around the body.

Food
Food is the body's source of energy and is also needed for growth. Food is made up of five constituents, carbohydrates (including fibre), fats, proteins, vitamins and minerals (two sources of each constituent). Each constituent has a particular function.

Different types of food have different energy content.

The body uses energy for movement and all other body functions. Energy requirements vary depending on age, sex and lifestyle.

Diet
A balanced diet is one where there is sufficient of each type of food constituent and of water. Lack of particular constituents result in specific health problems. An inadequate diet can result in malnutrition.

Teeth
There is a variety of teeth; all have a common structure. Tooth decay can be prevented by proper diet, dental hygiene and care.

Breathing
The breathing system gets oxygen into the body and gets rid of carbon dioxide and water vapour.

Transport/Circulation
Various materials are transported around the body in the blood. Blood is pumped by the heart and flows in blood vessels.

Excretion
The body produces waste which is removed by different organs.

Support and movement
The skeleton is the support framework for the body. Bones are moved by the action of muscles.

Senses
Each of the five senses has a specific sense organ. The senses communicate with the brain via nerves.

Respiration
Respiration is the process by which energy is released from some food constituents for the use of the body. Oxygen is used during respiration, carbon dioxide is usually released.

Reproduction, growth and development
Reproduction is the production of new individuals. Males and females have different roles in reproduction. Simple structure of the male and female reproductive systems. Ova and sperm are produced in the ovaries and testes respectively. The menstrual cycle and menstruation, the fertile period, family planning, intercourse, fertilisation, pregnancy and birth.

The above section to be discussed in the overall context of the ethos of the school.

B. The non-living environment

6.1 Matter

Matter occupies space and has mass. It exists in three states - solid, liquid and gas. Matter is made of tiny particles which can move. The state of a substance depends on the degree of movement of the particles. Substances can change from one state to another as they are heated or cooled.

6.2 The atom

Everything is made of atoms. They are vary small. They are made up of particles (names and location of these particles).

6.3 Elements, compounds and mixtures

Elements are made of atoms. All the atoms of an element are the same chemically.

Compounds are made of groups of two or more different atoms chemically combined together.

Mixtures are groups of different substances not chemically combined together.

6.4 Solutions

A solution is formed when one substance dissolves in another. Solutions can be concentrated or dilute. Some substances do not dissolve in others.

6.5 Separation techniques

Filtration, evaporation and distillation are separation techniques. Immiscible liquids can be separated using an appropriate technique. The choice of technique used for a separation depends on the substances being separated.

6.6 Everyday chemicals

Air

Air is a mixture of several gases which have specific properties. Oxygen and carbon dioxide can be prepared simply in the laboratory and can be tested for. Oxygen is needed for burning. Different types of fire extinguishers are effective for different types of fire. Precautions must be taken to avoid the risk of fire.

Water

Water is a compound of hydrogen and oxygen (H_2O). It has certain properties e.g. freezing/melting point, boiling/condensation point, surface tension, capillarity. These properties have everyday applications. As water moves through its cycle several changes of state are involved. Water is supplied to consumers having been purified by various means. In some areas of the country water is hard; in other areas it is soft. Hard and soft water have slightly different properties.

Fuels

Coal, oil, natural gas and turf are hydrocarbon - containing fuels with particular sources and varying availability. They are combustible and have combustion products.

7.1 Acids/bases/pH

Acids and bases are present in a wide variety of substances. The pH indicates whether a substance in aqueous solution is acidic, basic or neutral.

8.1 Metals

Metals have certain characteristics (lustre, malleability, ductility). Mixtures of metals are called alloys. Rusting causes damage to iron and can be prevented by appropriate methods.

6.7 Chemical reactions

A chemical reaction is a change in a substance or substances which results in the formation of one or more new substances.

12.1 Earth science

Location of the earth within the solar system relative to galaxies and the universe.

The earth is the only planet in the solar system known to be capable of sustaining life.

C. The living environment

9.1 Animals

There is a variety of types of animal, grouped into families. Animals, including humans, exhibit the characteristics of living organisms and as such should be respected.

9.2 The importance of animals

In agriculture animals can be a source of human food. Some animals cause damage to crops and livestock.

In medicine - many animals (e.g. humans, rats, mosquitoes, houseflies) can carry diseases. Animals are also used in medical research and drug development and testing.

Aquaculture is of importance in the fishing industry and fish farming. Conservation of fish stocks is vital for the fishing industry.

Many leisure activities involve animals - e.g. horses, dogs, other pets, zoos.

10.1 Plants

There is a wide variety of types of plants. They exhibit the characteristics of living organisms and as such should be respected.

10.2 Importance of plants

Plants act as a valuable resource in many areas e.g. as a source of oxygen and as the start of all foodchains.

In agriculture, plants are cultivated as a source of food.

In commerce, timber, cotton, linen and paper are important and derive from plants.

In medicine, many plants are the source of beneficial drugs (two examples).

Leisure activities associated with plants include, for example, gardening and nature trails. Plants have an important aesthetic value.

Recognition of plants: Plants can be identified by their flowers or leaves (three examples each of common local woody and non-woody plants).

10.3 Plant structure

The stem, the root, the leaf and the flower each have particular functions.

10.4 Photosynthesis

This is the means by which green plants make their food. Light, chlorophyll, water and carbon dioxide are required for photosynthesis. Solar energy is absorbed by the plant, used in photosynthesis and stored as food.

Oxygen is produced by plants during photosynthesis. This contributes to the atmospheric oxygen which is used by animals and plants during respiration.

10.5 Food chains

The energy stored by the plant can be consumed by animals. All the energy obtained by animals comes from plants and ultimately from the sun.

11.1 The environment
The meaning of the term environment and what it includes (specific reference to the local environment).

11.2 Habitat
There is a variety of habitats. Certain animals and plants are specific to certain habitats.

11.3 Conservation
There is a need to recognise the importance of the conservation of a wide variety of habitats e.g. mixed grassland, deciduous woodland, wetland and bogland.

11.4 Interrelationships
Living things depend on other living things for food and shelter. Food chains are examples of these interrelationships.

11.5 Pollution
Air and water pollution have a damaging effect on the environment and on health. Effluent and waste materials should be disposed of effectively and safely.

11.6 Micro-organisms
Micro-organisms exist almost everywhere and in large numbers. There is a wide variety of them and many are important in industry and medicine.

D. Energy

2.1 Energy

Energy is the ability to do work - that is the ability to move something. If a body has energy it can cause movement.

There are many different forms of energy e.g. electricity, heat, light, sound. Each of these has the ability to cause movement.

Energy can change from one form to another. It cannot be created or destroyed.

2.2 Energy needs

There are many ways of heating a home - these can be compared in terms of the effective cost of different energy sources.

Insulation reduces heat loss and increases the effectiveness of any heating system.

2.3 Energy supplies

Energy supplies can be categorised into renewable resources and non-renewable resources.

There is a finite supply of non-renewable energy sources - coal, oil, turf, gas - this supply is running out.

There is a plentiful supply of energy available from sources which are renewable - solar, wind, wave, hydroelectric and biomass. It is possible to generate electricity from these and thereby not consume non-renewable resources.

Comparisons of these fuels/resources can be made under various headings - costs, safety, pollution - both short- and long-term.

2.4 Nuclear energy

In a nuclear reaction energy is released from the nuclei of atoms. This energy is called nuclear energy and may be used to generate electricity. The waste products formed may be radioactive, that is they emit radiation. Many substances are naturally radioactive. While radioactive substances can be harmful to humans they also have uses in medicine and industry.

3.1 Heat

Heat is a form of energy.

Heat can be transferred from place to place. Heat will travel from a hotter to a colder region. There are three ways in which heat can be transferred.

Conduction is the transfer of heat through a solid e.g. along an iron bar.

Convection is the transfer of heat through a liquid or gas when the liquid or gas moves and carries the heat.

Radiation is the transfer of heat without the need for a medium.

3.2 Insulation

Insulation means the reduction of heat transfer from hot to cold. Materials differ in their insulating value.

A major function of clothing is heat insulation.

3.3 Expansion and contraction
Solids, liquids and gases expand when heated and contract when cooled. Water at temperatures between 0° and 4°C is an exception.

3.4 Temperature
Temperature is a measure of hotness.

The Celsius scale has fixed points assigned as 0°C and 100°C.

The normal temperature of humans is 37°C. Illness may cause a change in body temperature.

The mercury thermometer works by the expansion and contraction of mercury. The clinical thermometer has some modifications to suit its purpose.

4.1 Electricity
Electricity is a form of energy. This energy can be changed into other forms of energy.

4.2 In the home
The ampere, the volt and the watt are units used in electrical measurement.

For the purpose of costing, a unit called the kilowatt hour is used.

Electricity meters record the number of units (kWh) used and the electricity bill shows this reading. Different electrical appliances have different power ratings so they use different amounts of electricity in a given time and differ in the cost of their use.

4.3 Safety
Fuses and circuit breakers are included in domestic circuits for safety. The correct wiring of a plug is essential. Plugs, circuits and wires can be overloaded, causing excessive heat production and fire risk.

4.4 Magnetism
Magnets. Magnetic fields cause attraction and repulsion. A compass depends on a suspended magnet reacting to the magnetic field of the earth.

5.1 Light is a form of energy. White light is made up of different colours mixed together. Light may be reflected from a surface.

5.2 Sound is a form of energy. Sound is produced by vibrations. Sound needs a substance (a medium) through which it can travel. Sound may be reflected from certain surfaces - this can result in echoes.

PHYSICS

2. FORCES AND MOTION

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2.1 Energy

Energy is the ability to do work - that is the ability to move something. If a body has energy it can cause movement.

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2.4 Nuclear energy

In a nuclear reaction energy is released from the nuclei of atoms. This energy is called nuclear energy and may be used to generate electricity. The waste products formed may be radioactive, that is they emit radiation. Many substances are naturally radioactive. While radioactive substances can be harmful to humans they also have uses in medicine and industry.

	ORDINARY LEVEL	HIGHER LEVEL
2.5	Mass Defined as the quantity of matter in an object	Concept of mass as distinct from weight
2.6	Density Definition of density Determination of density of a solid	Density as a characteristic property of a particular substance Determination of density of a liquid Flotation - related to density (no treatment of Archimedes' principle)

ORDINARY LEVEL	HIGHER LEVEL
2.7 Motion Speed Definition of speed as distance/time Simple numerical calculations	Velocity Definition of velocity in terms of speed in a stated direction Acceleration Definition of acceleration as rate of change of velocity Simple numerical calculations on acceleration
2.8 Forces Simple description and examples of forces	Definition of force Unit of force The effects of forces; action-reaction; momentum
2.9 Weight and gravity The effect of gravity on a mass as a downward force	Weight as a force
2.10 Friction A contact force, effects of different surfaces and of lubrication on friction	
2.11 Turning effect of a force - levers Simple levers - everyday examples	Levers Moment of force Law of the lever
2.12	Centre of gravity Stability, equilibrium, determination of centre of gravity Centre of gravity in design
2.13	Work and energy Work = force x distance (joule) Energy is the ability to do work
2.14 Pressure Description and everyday examples	Definition. Force/area
2.15	Pressure in liquids Water supply systems
2.16 Atmospheric pressure Evidence for atmospheric pressure	Atmospheric pressure varies with height Mercury barometer (not to be made) Anaeroid barometer Relationship of atmospheric pressure to weather

3. HEAT

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3.1 Heat

Heat is a form of energy.

Heat can be transferred from place to place. Heat will travel from a hotter to a colder region. There are three ways in which heat can be transferred.

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Convection is the transfer of heat through a liquid or gas when the liquid or gas moves and carries the heat.

Radiation is the transfer of heat without the need for a medium.

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Insulation means the reduction of heat transfer from hot to cold. Materials differ in their insulating value.

A major function of clothing is heat insulation.

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Solids, liquids and gases expand when heated and contract when cooled. Water at temperatures between 0^{o} and $4^{o}C$ is an exception.

3.4 Temperature

Temperature is a measure of hotness.

The Celsius scale has fixed points assigned as $0^{o}C$ and $100^{o}C$.

The normal temperature of humans is $37^{o}C$. Illness may cause a change in body temperature.

The mercury thermometer works by the expansion and contraction of mercury. The clinical thermometer has some modifications to suit its purpose.

ORDINARY LEVEL	HIGHER LEVEL
3.5 Heat and temperature The difference between heat and temperature	
3.6 Thermometers Types of thermometer: mercury, alcohol	
3.7 Effects of heat	
Changes of state Solid to liquid Liquid to gas	Sublimation Effect of pressure on melting point and boiling point Kinetic models of these phenomena Latent heat (not quantitative)
Expansion and contraction	

ORDINARY LEVEL	HIGHER LEVEL
3.8 Heat Transfer Conduction, convection and radiation Metals as conductors of heat; comparisons of metals in order of conductivity (copper, iron, zinc, aluminium) Insulation Effectiveness of different substances Awareness of tog values	

4. ELECTRICITY AND MAGNETISM

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4.1 Electricity

Electricity is a form of energy. This energy can be changed into other forms of energy.

4.2 In the home

The ampere, the volt and the watt are units used in electrical measurement.

For the purpose of costing, a unit called the kilowatt hour is used.

Electricity meters record the number of units (kWh) used and the electricity bill shows this reading. Different electrical appliances have different power ratings so they use different amounts of electricity in a given time and differ in the cost of their use.

4.3 Safety

Fuses and circuit breakers are included in domestic circuits for safety. The correct wiring of a plug is essential. Plugs, circuits and wires can be overloaded causing excessive heat production and fire risk.

4.4 Magnetism

Magnets. Magnetic fields cause attraction and repulsion. A compass depends on a suspended magnet reacting to the magnetic field of the earth.

ORDINARY LEVEL	HIGHER LEVEL
4.5	Electric charge Bodies (objects) can be charged - this involves the addition or removal of electrons Current will flow from a positively charged body to a negatively charged body if they are connected by a conductor
4.6 Electric current As a flow of electric charge Conductors Electric charge can flow freely Insulators The flow of electric charge is inhibited	
4.7 Effects of current Heating effect	Chemical effect c.f. electrochemistry Magnetic effect - straight line conductor and solenoid

ORDINARY LEVEL	HIGHER LEVEL
4.8	Relationship of units Ohm's law for a metallic conductor V/I = constant, the resistance measured in ohms Watts = amps x volts
4.9 Circuits Simple circuits Domestic ring circuits and spurs	The difference between resistances in series and in parallel Simple calculations on resistances in series
4.10	AC/DC Distinction between a.c. and d.c. It is possible to change from one to the other.
4.11 Mains electricity Need for and function of each of the three terminals on a plug	

5. LIGHT AND SOUND

The core is printed in **bold type.**

5.1 **Light is a form of energy. White light is made up of different colours mixed together. Light may be reflected from a surface.**

5.2 **Sound is a form of energy. Sound is produced by vibrations. Sound needs a substance (a medium) through which it can travel. Sound may be reflected from certain surfaces - this can result in echoes.**

	ORDINARY LEVEL	HIGHER LEVEL
5.3		Properties of waves Means of transmitting energy Wavelength, frequency, speed, amplitude Reflection Speed of a wave = frequency x wavelength Calculation of simple problems
5.4		Electromagnetic radiation Electromagnetic spectrum, from radio to gamma waves
5.5	Light Light rays, shadows, eclipses Reflection Reflection from plane surface	
		Refraction Qualitative treatment only: the bending of light as it passes from one substance to another
		Lenses Qualitative treatment only: concave lenses diverge light rays, convex lenses converge light rays
	Colour Dispersion of light e.g. by prism or diffraction grating Mixing of colours	
5.6		Sound Sound as waves and as vibrations Requirement of a medium for transmission of sound Echoes, speed of sound (not to be measured) Pitch depends on frequency

CHEMISTRY

6. MATTER, THE ATOM AND ELEMENTS

The core is printed in bold type.

6.1 Matter

Matter occupies space and has mass. It exists in three states - solid, liquid and gas. Matter is made of tiny particles which can move. The state of a substance depends on the degree of movement of the particles. Substances can change from one state to another as they are heated or cooled.

6.2 The atom

Everything is made of atoms. They are very small. They are made up of particles (names and location of these particles).

6.3 Elements, compounds and mixtures

Elements are made of atoms. All the atoms of an element are the same chemically.

Compounds are made of groups of two or more different atoms chemically combined together.

Mixtures are groups of different substances not chemically combined together.

6.4 Solutions

A solutions is formed when one substance dissolves in another. Solutions can be concentrated or dilute. Some substances do not dissolve in others.

6.5 Separation techniques

Filtration, evaporation and distillation are separation techniques. Immiscible liquids can be separated using an appropriate technique. The choice of technique used for a separation depends on the substances being separated.

6.6 Everyday chemicals

Air

Air is a mixture of several gases which have specific properties. Oxygen and carbon dioxide can be prepared simply in the laboratory and can be tested for. Oxygen is needed for burning. Different types of fire extinguishers are effective for different types of fire. Precautions must be taken to avoid the risk of fire.

Water

Water is a compound of hydrogen and oxygen (H_2O). It has certain properties e.g. freezing/melting point, boiling/condensation point, surface tension, capillarity. These properties have everyday applications. As water moves through its cycle several changes of state are involved. Water is supplied to consumers having been purified by various means. In some areas of the country water is hard, in other areas it is soft, hard and soft water have slightly different properties.

Fuels

Coal, oil, natural gas and turf are hydro-carbon containing fuels with particular sources and varying availability. They are combustible and have combustion products.

6.7 Chemical reactions

A chemical reaction is a change in a substance or substances which results in the formation of one or more new substances.

ORDINARY LEVEL	HIGHER LEVEL
6.8 The atom	
Concept of size	
Symbols	
Structure	
Sub-atomic particles - mass, charge, location	Organisation of particles in atoms no. 1-20
	Definition of mass number and atomic number
6.9 The molecule	
A group of 2 or more atoms combined	
6.10 Classification of elements and the periodic table	
(i) On the basis of the chemical behaviour of the atoms as shown by group I elements	(ii) On the basis of the chemical behaviour of the atoms as shown by group II elements (iii) On the basis of atomic number (iv) On the basis of the number of outer electrons
6.11 Groups of elements	
Alkali metals	
Similarity of properties	Halogens Noble gases Trends within groups (no practical work)
6.12 Metals/Non-metals	
Division of periodic table into metal/non metals	
Ion	
Definition	Valency, simple formulae
Ion formation	
As gain or loss of eletrons	
	Ionic bonding Simple examples, sodium chloride crystal structure Characteristics of ionic substances Electrolysis Composition of water Covalent bonding Sharing of pairs of electrons Characteristics of covalent substances
6.13 Oxidation and reduction	
Oxidation as gain of oxygen	In terms of gain and loss of electrons and in terms of oxygen and hydrogen transfer
6.14 Heat changes in chemical reactions	Chemical reactions can lead to a change in temperature
	Exothermic reactions - heat is given out: one example
	Endothermic reaction - heat is taken in: one example

7. ACIDS, BASES AND WATER

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7.1 Acids/bases/pH

Acids and bases are present in a wide variety of substances. The pH indicates whether a substance in aqueous solutions is acidic, basic or neutral.

	ORDINARY LEVEL	HIGHER LEVEL
7.2	pH scale and pH indicators The pH scale Indicators (litmus and universal indicator)	
7.3	Reactions of acids Reaction of an acid (hydrochloric) with a metal (zinc) Reaction of an acid (hydrochloric) with a base (sodium hydroxide) Reaction of an acid (hydrochloric) with a carbonate (calcium carbonate) Word equations only	Reaction of an acid (sulphuric) with metals (zinc and magnesium) Reaction of an acid (sulphuric) with a base (sodium hydroxide) Reaction of an acid (sulphuric) with a carbonate (sodium carbonate) Chemical equations
7.4		Neutralisation Formation of a salt and water from an acid and a base
7.5	Acid rain and its effects Results of acid rain pollution Gases from combustion of fuels contain sulphur dioxide and carbon dioxide	Solubility of sulphur dioxide and carbon dioxide to form acids Effects of acid rain on the environment
7.6	Water treatment for domestic purposes - by settling - by filtration - by chlorination/fluoridation	
7.7	Hard & soft water Salts (e.g. of calcium and magnesium) often dissolve in water leading to hard water Testing for hardness using soap solution Types of hardness - temporary and permanent Temporary hardness can be removed by boiling, permanent cannot	Calcium and magnesium ions lead to hardness Group II Hydrogen carbonates lead to temporary hardness Other ions (e.g. sulphates) lead to permanent hardness Removal of hardness - by boiling - by ion exchange

8. METALS AND ELECTROCHEMISTRY

The core is printed in bold type.

8.1 Metals

Metals have certain characteristics (lustre, malleability, ductility). Mixtures of metals are called alloys. Rusting causes damage to iron and can be prevented by appropriate methods.

ORDINARY LEVEL	HIGHER LEVEL
8.2 Conductivity of metals Heat and electrical conductivity of metals	Comparison between metals and non-metals
8.3	Corrosion Relative corrodability of metals Purity of metals affects corrodability Corrosion returns metals to their ore state
8.4 Getting electricity from chemicals A simple cell involving two metals and an electrolyte	Different combinations of metals produce different voltages
8.5	Activity series List of metals in order of reactivity (K, Na, Ca, Mg, Zn, Fe, Cu, Ag) Acidic and basic oxides
8.6	The dry cell Structure of the dry cell
8.7 Effects of electricity on substances	Electrolysis Electric current breaks down substances to elements e.g. water
Electroplating One metal can be deposited on another by electricity e.g. copperplating	

BIOLOGY

9. ANIMAL BIOLOGY

The core is printed in **bold type.**

9.1 Animals

There is a variety of types of animals. These are grouped into families. Animals, including humans, exhibit the characteristics of living organisms and as such should be respected.

9.2 The importance of animals

In agriculture animals can be a source of human food. Some animals cause damage to crops and livestock.

In medicine - many animals (e.g. humans, rats, mosquitoes, houseflies) can carry diseases. Animals are also used in medical research and drug development and testing.

Aquaculture is of importance in the fishing industry and fish farming. Conservation of fish stocks is vital for the fishing industry.

Many leisure activities involve animals - e.g. horses, dogs, other pets, zoos.

9.3 The human body

The human is an organism with a variety of systems to carry out a range of functions. Each system has a particular structure which enables it to carry out its functions.

Nutrition

The digestive system takes in food for the nutrition of the body. The food is digested by the system and is then distributed around the body.

Food

Food is the body's source of energy and is also needed for growth. Food is made up of five constituents, carbohydrates (including fibre), fats, proteins, vitamins and minerals (two sources of each constituent). Each constituent has a particular function.

Different types of food have different energy content.

The body uses energy for movement and all other body functions. Energy requirements vary depending on age, sex and lifestyle.

Diet

A balanced diet is one where there is sufficient of each type of food constituent and of water. Lack of particular constituents result in specific health problems. An inadequate diet can result in malnutrition.

Teeth

There is a variety of teeth; all have a common structure. Tooth decay can be prevented by proper diet, dental hygiene and care.

Breathing

The breathing system gets oxygen into the body and gets rid of carbon dioxide and water vapour.

Transport/Circulation
Various materials are transported around the body in the blood. Blood is pumped by the heart and flows in blood vessels.

Excretion
The body produces waste which is removed by different organs.

Support and movement
The skeleton is the support framework for the body. Bones are moved by the action of muscles.

Senses
Each of the five senses has a specific sense organ. The senses communicate with the brain via nerves.

Respiration
Respiration is the process by which energy is released from some food constituents for the use of the body. Oxygen is used during respiration, carbon dioxide is usually released.

Reproduction growth and development
Reproduction is the production of new individuals. Males and females have different roles in reproduction. Simple structure of the male and female reproductive systems. Ova and sperm are produced in the ovaries and testes respectively. The menstrual cycle and menstruation, the fertile period, family planning, intercourse, fertilisation, pregnancy and birth.

The above section to be discussed in the overall context of the ethos of the school.

	ORDINARY LEVEL	HIGHER LEVEL
9.4	Cells Basic cell structure	Tissues; organs Cell division allows for growth Variety of cell types
9.5	Nutrition Taking in, breaking down and using food	Ingestion, digestion, absorption, assimilation, egestion End products of digestion
	Digestion - mechanical (chewing, types of teeth) - chemical (breakdown by chemicals called enzymes)	Enzyme catalysed reaction - as shown by breakdown of starch to glucose only

	ORDINARY LEVEL	HIGHER LEVEL
	Anatomy of the digestive system Identification and function of major parts	
9.6	Breathing system Anatomy of the breathing system Identification and function of major parts	Link with blood system - alveoli and capillaries One example of an alternative system of gaseous exchange e.g. gills, spiracles, body surface
9.7	Transport/Circulation system Composition and function of blood Blood vessels - function Heart - function and care	 Blood vessels - structure Heart - structure
9.8	Excretion Excretory organs - function, location and excretory products of kidneys, lungs and skin	Anatomy of urinary system Identification and function of major parts
9.9	Skeleton Functions of skeleton - support, protection and movement	Joints: Examples of different types Structure of synovial joint Antagonistic muscles, ligaments, tendons
9.10		Sensitivity and co-ordination The eye - structure and function of parts Nerves - sensory and motor - functions only Endocrine system - one example of a named gland and hormone
9.11	Respiration Definition (word equation only) Requirement of oxygen and release of carbon dioxide	Full chemical equation
9.12		Inheritance Inheritable/non-inheritable characters Gametes Chromosomes, genes Inheritance of simple character

10. PLANT BIOLOGY

The core is printed in bold type.

10.1 Plants

There is a wide variety of types of plants. They exhibit the characteristics of living organisms and as such should be respected.

10.2 Importance of plants

Plants act as a valuable resource in many areas e.g. as a source of oxygen and as the start of all foodchains.

In agriculture, plants are cultivated as a source of food.

In commerce, timber, cotton, linen and paper are important and derive from plants.

In medicine, many plants are the source of beneficial drugs (two examples).

Leisure activities associated with plants include, for example, gardening and nature trails. Plants have an important aesthetic value.

Recognition of plants: Plants can be identified by their flowers or leaves (three examples each of common local woody and non-woody plants).

10.3 Plant structure

The stem, the root, the leaf and the flower each have particular functions.

10.4 Photosynthesis

This is the means by which green plants make their food. Light, chlorophyll, water and carbon dioxide are required for photosynthesis. Solar energy is absorbed by the plant, used in photosynthesis and stored as food.

Oxygen is produced by plants during photosynthesis. This contributes to the atmospheric oxygen which is used by animals and plants during respiration.

10.5 Food chains

The energy stored by the plant can be consumed by animals. All the energy obtained by animals comes from plants and ultimately from the sun.

ORDINARY LEVEL	HIGHER LEVEL
10.6 Plant cells	
Basic cell structure	
Transport tissue, storage tissue, photosynthetic tissue	Xylem and phloem Growing tissue (cambium)
10.7 Plant nutrition	
Photosynthesis	
Word equation	Full chemical equation
	Mineral requirements Plants need nitrogen, phosphorus, potassium and other minerals for growth. Lack of any produces abnormal growth. (Specific deficiency symptoms not required.)

ORDINARY LEVEL	HIGHER LEVEL
10.8 Transport	
The existence of a flow of water from absorption in the roots to evaporation from the leaves	Transpiration As evaporation of water from leaf surface Factors affecting transpiration Flow of food materials in phloem vessels
10.9 Responsiveness	
Phototropism defined as a growth response to light	Geotropism defined as a growth response to gravity
10.10 Respiration See Animal biology	
10.11 Reproduction	
Sexual & asexual Define both types of reproduction to show the difference between the two in terms of fertilisation	
Flower Flower as organ of reproduction: four major parts of the flower and their functions (sepal, petal, carpel and stamen only)	Stigma, style, ovary, anther and filament Pollination leading to fertilisation Pollen produces male gamete Pollen dispersal - wind - insect
Methods of seed dispersal, wind, animal, self and water	
Germination Conditions for germination	
	Life cycle Reproduction of a named flowering plant in context of a cycle

11. ECOLOGY

The core is printed in bold type.

11.1 The evironment
The meaning of the term environment and what it includes (specific reference to the local environment).

11.2 Habitat
There is a variety of habitats. Certain animals and plants are specific to certain habitats.

11.3 Conservation
There is a need to recognise the importance of the conservation of a wide variety of habitats e.g. mixed grassland, deciduous woodland, wetland and bogland.

11.4 Interrelationships
Living things depend on other living things for food and shelter. Food chains are examples of these interrelationships.

11.5 Pollution
Air and water pollution have a damaging effect on the environment and on health. Effluent and waste materials should be disposed of effectively and safely.

11.6 Micro-organisms
Micro-organisms exist almost everywhere and in large numbers. There is a wide variety of them and many are important in industry and medicine.

ORDINARY LEVEL	HIGHER LEVEL
11.7 Habitat study Fieldwork study of any one local habitat to demonstrate the following principles:	
Transfer of energy within an ecosystem Food chains Adaptation to environment) one Competition between) named species and within a) example species) of Interdependence) each	Food web Trophic levels
	The need for wise management of the earth's resources An awareness of desertification and deforestation
11.8 Soil study	
Humus content and mineral content pH Availability of water and air in the soil Existence of soil organisms - one named example	Nutrient content of soil: nitrogen, phosphorus and potassium Leaching and pollution Existence of micro-organisms in soil

APPLIED SCIENCE

12. EARTH SCIENCE

The **core** is printed in **bold type.**

12.1 Earth Science

Location of the earth within the solar system relative to galaxies and the universe.

The earth is the only planet in the solar system known to be capable of sustaining life.

ORDINARY LEVEL	HIGHER LEVEL
12.2 The sun The sun as a star The calendar, day, year as astronomical phenomena The seasons Eclipses	Outline life cycle of any star
12.3 The moon The moon as a satellite of earth Phases of the moon Lunar eclipses	Spring and neap tides
12.4 The planets The orbits of the planets	A comparison of the earth with one other planet and with the moon with regard to: relative size, distance from the sun, surface gravity, surface temperature, atmosphere and planetary moons
12.5 Water in the atmosphere Evaporation and condensation are dependent on temperature and wind Humidity, measurement Recognition of clouds	Formation of fog, frost and clouds
12.6 Pressure in the atmosphere Measurement of atmospheric pressure Variation in density and pressure of atmosphere with altitude	Properties of gases Pressure, variation of volume with temperature and pressure

ORDINARY LEVEL	HIGHER LEVEL
12.7	Transfer of energy from the sun to earth Absorption of solar energy by earth Land and sea breezes
12.8 Instrumentation Measurement of wind speed, pressure, temperature, rainfall	
12.9 Local weather recording Monitoring and record keeping over time	

13. HORTICULTURE

ORDINARY LEVEL	HIGHER LEVEL
13.1 Soils/composts: Plant nutrition	
The need for a growing medium for plants, awareness of various different media including hydroponics Relate to respiration and to water transport in plants Soil structure, role of earthworms	
Measurement of air and water content of soil and of a compost mixture of 50% peat and 50% sand	Plant nutrients Qualitative experiments on deficiency of nitrogen, phosphorous and potassium pH testing of soil
13.2 Propagation	
Seeds: Dormancy, seed sowing, germination, percentage of germination two examples from: lettuce, a root crop, a brassica, a spring bedding plant, an amenity grass variety, a native deciduous tree	
Cuttings: as production of identical offspring. Taking cuttings from a woody and a non-woody plant	Grafting: growth from the cambium layer grafting of apple, ash, birch or other
13.3 Growing on/cultural practices	
Reference to factors necessary for optimum plant growth and photosynthesis including availability of water, nutrients, air, adequate temperature and space	
	Growth habits of bent, fescue and dwarf ryegrass Their use in amenity areas Naturalised meadowland

ORDINARY LEVEL	HIGHER LEVEL
Growth to maturity of one vegetable	
Bedding out of spring bedding plants and their aftercare	
Growing of a pot plant, stopping and training	
	Use of mulches for moisture saving and weed control
Harvesting and aftercare of cut flowers	
13.4 Diseases and pests: crop protection	
Life cycle of aphid or cabbage white butterfly and their principal host plants	
	Pest control: biological control of one pest, chemical control of one pest Integrated pest management

14. MATERIALS SCIENCE

ORDINARY LEVEL	HIGHER LEVEL
14.1 Identification of materials Identification of materials in the pupils environment Classification of materials (i) natural or synthetic (ii) into categories: (a) Hydrocarbons (b) Plastics (c) Textiles (d) Metals (e) Others	Mixtures/combinations of materials e.g. alloys, textiles comprising synthetic and natural fibres
14.2 Uses of materials Identification of different materials which may be used for a particular purpose Identification of different uses which can be made of a particular material Care of materials - the importance of following the manufacturers instructions Reference to labelling and safety symbols	
14.3 Properties of materials **Any one** of the following - Plastics, Textiles, Metals, Timber Plastics The origin and development of hydrocarbon deposits The importance of oil in the production of plastics and synthetic fibres Investigation of properties - how they feel (flexibility, hardness) - how they may be cut - their density - how they burn, flammability and flameproofing and the dangers associated with burning, fumes, pollution etc. (theory only) - comparison of insulating properties	**Any two** of the following - Plastics, Textiles, Metals, Timber

ORDINARY LEVEL	HIGHER LEVEL
Textiles The origin of textile fibres - animal, vegetable and synthetic The production of yarn from fibres and of fabric from yarn Investigation of properties - how they feel - comparison of insulating properties - comparison of absorbancy - comparison of flammability and flameproofing (theory only) - comparison of resistance to wear Metals The origin of metals and the extraction of one metal from its ores (reference to mining in Ireland) Investigation of properties - how they feel - flexibility and hardness - comparison of thermal conductivity - comparison of densities - comparison of reactivity (activity series) Timber and manufactured boards Origin of timber, hardwood and softwood Forestry in Ireland Awareness of manufactured boards and their structure Investigation of properties - how they feel - comparison of densities - effect of moisture - effect of grain direction on strength - strength testing	
14.4	Protection of materials Materials deteriorate for a variety of reasons, weather, pest infestation corrosion of metals etc. Most materials can be protected from the agent of attack e.g. pesticide treatment, painting, galvanising, electroplating, biodegradability.

15. FOOD

ORDINARY LEVEL	HIGHER LEVEL
15.1 Food types	
Carbohydrate, fat, protein: sources and functions	Structure (elements)
Food tests - starch, reducing sugar protein and fat	
Fibre as a carbohydrate - role and importance in health	
Vitamins & minerals: overall role and importance	Two examples and two sources of vitamins and minerals
Balanced diet: dieting	
15.2 Food processing	
Dairy industry: pasteurisation, cheese, butter, yoghurt production	Basic principles involved in these processes: action of micro-organisms
Meat industry: curing, smoking	Hormones and antibiotics in meat production
Brewing: alcohol production - distillation	Fermentation
Silage making	
	Biotechnology: definition only
15.3 Food preservation	
Reasons for food preservation	
Methods: e.g. pasteurisation, freezing and cold storage, canning, dehydration, use of chemical additives	sugar/salt concentration, irradiatio
15.4 Food additives	
Advantages and disadvantages of food additives	Types of additives: preservatives an anti-oxidants.
E-numbers, colourings	
15.5	World food supply
	Problems of supply and distribution
	Famine - causes and effects

16. ELECTRONICS

ORDINARY LEVEL	HIGHER LEVEL
16.1 Simple circuits (See section 4.9) The diode in a circuit	
16.2 Light emitting diodes (LED) (i) in a circuit (ii) two LEDs in parallel in a circuit Use of a red LED and a green LED to make a current/voltage direction indicator	
16.3 Switches (using LEDs as indicators) (or using bleepers or buzzers) (i) one switch in a circuit (ii) two switches in series in a circuit (iii) two switches in parallel in a circuit (iv) two-way switches	(v) water level detector
16.4 Variable resistor (i) to vary current flow	(ii) as a potentiometer to vary voltage
16.5	Transistor (1) simple circuit using an LDR and transistor (with LED or bleeper or buzzer) (2) to build a simple burglar alarm
16.6 Light dependent Register (LDR) in a simple circuit	
16.7	Transducers Use of electronic systems to control a situation involving one variable (two examples).

17. ENERGY CONVERSIONS

	ORDINARY LEVEL	HIGHER LEVEL
17.1	The sun is the principal source of energy available to people	
17.2	Identification of different examples of stored energy	
17.3	Identification of different examples of kinetic energy	
17.4	Identification of energy changes in various systems; the form in which the energy is supplied, any intermediate forms and the form to which it has been converted Simple examples such as the following a) Mechanical energy to heat b) Mechanical energy to sound c) Chemical energy to heat d) Chemical energy to electrical energy to light to heat e) Electrical energy to magnetic energy to kinetic energy f) Light energy to electrical energy to kinetic energy	
17.5	Investigation of the release of stored energy from food	
17.6	Electromagnets Making a simple d.c. electromagnet	
17.7		Electric bell as an application of electromagnetism
17.8	Electric motor The effect on a current carrying conductor in a magnetic field. Making a simple d.c. motor	
17.9	Dynamo	Production of a voltage by the movement of a conductor through an magnetic field: the dynamo effect
17.10	Transformer	A device for increasing or decreasing an a.c. voltage Making a simple transformer

LOCAL STUDIES

LOCAL STUDIES

The local studies extension has an open content and will take the form of student coursework based on a scientific study of some aspect of the locality.

The extension will be assessed on the basis of student coursework, which will account for up to 40% of marks at ordinary level and at higher level will be equal in value to one extension.

Student work should contain an element of laboratory work and an element of field study. Detailed guidelines for practical work, to be carried out as part of the Local Studies extension, will be provided to schools. Coursework assessment should take into account the extent to which assessment objectives nos. V.3-V.12 are met.

Examination of coursework will take into account procedures and practices pertaining to the former Rural Science syllabus where student coursework would be examined by an examiner appointed by the Department of Education and the student would have an oral examination based on the coursework presented.

For an interim period the Local Studies option will be confined to those schools where Rural Science was taught for the Day Vocational (Group) Certificate.