HIGHER LEVEL COMBINED SCIENCE SYLLABUS

Section 1: Biology

B 1 Keeping healthy

B 1.1 Diet and exercise

A healthy diet
Malnourishment: too fat or too thin.
Metabolic rate varies with the amount of activity you do and the proportion of muscle to fat in your body.
Obesity and the diseases linked to excess weight: arthritis, diabetes, high blood pressure and heart disease.
Cholesterol
Too much salt in the diet can lead to increased blood pressure

B 1.2 How our bodies defend themselves against infectious diseases

Contribution of Semmelweiss in controlling infection in hospitals
Advantages and disadvantages of being vaccinated
Antibiotics
Consequences of mutations of bacteria and viruses
Epidemics and pandemics eg bird influenza.
Microorganisms: Bacteria and viruses
White blood cells: ingesting pathogens, producing antibodies, producing antitoxins.
MRSA: over use of antibiotics
Vaccination

B 2 Nerves and hormones

B 2.1 The nervous system

Receptors detect stimuli
The brain coordinates the response.
Reflex actions are automatic and rapid. They often involve sensory, relay and motor neurones.

B 2.2 Control in the human body

Temperature control
Blood sugar level regulation
Hormones regulating the menstrual system
FSH
Oestrogen
LH.
The uses of hormones in controlling fertility
Oral contraceptives

B 3 Control in plants

Auxin

Uses of plant hormones

B 4 The use and abuse of drugs

B 4.1 Drugs and Clinical trails

Development and trial of new drugs
Thalidomide
Recreational drugs

B 4.2 Abuse of drugs

Addiction
Cannabis, cocaine, heroin, alcohol
Nicotine, Smoking and its effects

B 5 Interdependence and adaptation

B 5.1 Adaptations

Animals and plants may be adapted for survival in the conditions where they normally live e.g. deserts, the Arctic.

B 5.2 Interdependence

Food chains

B 6 Environmental change

B 6.1 Effect of environment on distribution

Factors affecting distribution
Measuring distribution of species

B 6.2 Effect of humans on environment

Issues related to rapid growth in the human population
Living organisms used as indicators of pollution: lichens
Deforestation
Recycling
Global Warming
Sustainable development

B 7 Energy in biomass

Pyramids of biomass
Increasing efficiency of food production

B 8 Waste materials from plants and animals

B 8.1 Decay processes

Factors increasing decomposition

B 8.2 The carbon cycle

B 9 Genetic variation and its control

B 9.1 Why organisms are different

Genes and chromosomes

DNA

Clones

B 9.2 Inheritance

Genetic cross diagrams

Cloning techniques: tissue culture, embryo transplant, fusion cell and adult cell cloning

Genetic engineering techniques

Economic, social and ethical issues concerning cloning and genetic engineering, including GM crops.

B 10 Reproduction

B 10.1 Sexual reproduction

The joining (fusion) of male and females gametes.

The mixture of the genetic information from two parents leads to variety in the offspring

B 10.2 Asexual reproduction.

No fusion of gametes and only one individual is needed as the parent.

There is no mixing of genetic information and so no variation in the offspring.

These genetically identical individuals are known as clones.

B 11 Evolution

Interpret evidence relating to evolutionary theory

Darwin's theory of natural selection

Differences between Darwin's theory of evolution and conflicting theories

Fossils.

Causes of Extinction.

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Section 2: Chemistry

C 1 The fundamental ideas in chemistry

C 1.1 Atoms

All substances are made of atoms
Chemical symbol of atoms, e.g. O is oxygen
Structure of atoms
Element
Molecule

C 1.2 The periodic table

Groups: I, II, VII, Noble gases

Periods

C 1.3 Chemical reactions

Atoms react to make compounds
Ionic and Covalent bonding
The formula of a compound shows the number and type of atoms that are joined together to make the compound.
No atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants
Balanced equations

C 2 Limestone and building materials

C 2.1 Calcium carbonate

Limestone, containing the compound calcium carbonate ($CaCO_3$), is quarried and can be used as a building material.
Thermal decomposition of $CaCO_3$ and other carbonates
Quicklime (calcium oxide)
Slaked lime (calcium hydroxide)

C 2.2 Products from limestone

Environmental, social and economic effects of exploiting limestone and producing building materials from it
Cement, concrete and glass as building materials, and their advantages and disadvantages over other materials

C 3 Metals and their uses

C 3.1 Extracting metals

Iron Ore and blast furnace
Extraction of copper
Transition metals: Titanium and Aluminium and there extraction
Social, economic and environmental impacts of exploiting metal ores, of using metals and of recycling metals

C3.2 Reactivity series
Un-reactive metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal.
Metals that are less reactive than carbon can be extracted from their oxides by reduction with carbon, for example iron oxide is reduced in the blast furnace to make iron.

C 4 Alloys

C 4.1 Steel and other alloys
Steels are alloys: mixtures of iron with carbon and other metals.
The different sized atoms added distort the layers in the structure of the pure metal, making it more difficult for them to slide over each other, and so alloys are harder.
Alloys can be designed to have properties for specific uses.
Smart alloys
Properties of alloys (but not smart alloys) are related to models of their structures.

C 4.2 Properties and uses of metals
Properties and uses of pure iron
Properties and uses of Transition metals Titanium and Aluminium

C 5 Crude oil and fuels

C 5.1 Crude oil
Mixture
Crude oil is a mixture of a very large number of compounds.
Most of the compounds in crude oil consist of molecules made up of hydrogen and carbon atoms only (hydrocarbons). Most of these are saturated hydrocarbons called alkanes, which have the
general formula C_nH_{2n+2}

C 5.2 Fractional distillation
Method of fractional distillation to separate components of crude oil

C 5.3 Hydrocarbons
Alkane molecules can be represented as C_nH_{2n+2} example C_2H_6
Structural diagrams of hydrocarbons
Alkenes general formula C_nH_{2n}: C_2H_4

C 6 Hydrocarbon fuels

C 6.1 Other useful substances from crude oil

Most fuels contain carbon and/or hydrogen and may also contain some sulfur. The gases released into the atmosphere when a fuel burns may include carbon dioxide, water (vapour), carbon
monoxide and sulfur dioxide. Particles may also be released.
Sulfur dioxide causes acid rain, carbon dioxide causes global warming, and particles cause global dimming.
Sulfur can be removed from fuels before they are burned, for example in vehicles.

C 7 Obtaining useful substances from crude oil

C 7.1 Cracking

Cracking as a thermal decomposition reaction
Products of cracking: alkanes and unsaturated hydrocarbons called alkenes.
Products used as Fuels

C 8 Polymers and Ethanol

C 8.1 Polymers and plastics

Monomers and polymers
Alkenes can be used to make polymers such as poly(ethene) and poly(propene).
Polymers have properties that depend on what they are made from and the conditions under which they are made. For example, slime with different viscosities can be made from poly(ethenol).
Polymers have many useful applications and new uses are being developed, for example: new packaging materials, waterproof coatings for fabrics, dental polymers, wound dressings, hydrogels smart materials, including shape memory polymers.
Many polymers are not biodegradable, so they are not broken down by microorganisms

C 8.2 Ethanol

Ethene can be reacted with steam in the presence of a catalyst to produce ethanol.
Advantages and disadvantages of making ethanol from renewable and non-renewable sources

C 9 Plant oils and their uses

C 9.1 Vegetable oils

Effects of using vegetable oils in foods and the impacts on diet and health
Benefits, drawbacks and risks of using vegetable oils to produce fuels
Vegetable oils

C 9.2 Emulsions

Emulsions and uses

C 9.3 Saturated and unsaturated oils

Effect on health
Hydrogenated oils

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C 10 Changes in the Earth and its atmosphere

C 10.1 The Earth's crust

The Earth consists of a core, mantle and crust.
Theory of crustal movement (continental drift) and why it was not accepted
Why scientists cannot accurately predict when earthquakes and volcanic eruptions will occur
Tectonic plates
Convection currents within the Earth's mantle, driven by heat released by natural radioactive processes, cause the plates to move at relative speeds of a few centimeters per year.
The movements can be sudden and disastrous. Earthquakes and/or volcanic eruptions occur at the boundaries between tectonic plates.

C 10.2 The Earth's atmosphere

For 200 million years, the proportions of different gases in the atmosphere have been much the same as they are today:

- about four-fifths (80%) nitrogen
- about one-fifth (20%) oxygen
- small proportions of various other gases, including carbon dioxide, water vapour and noble gases.

During the first billion years of the Earth's existence there was intense volcanic activity. This activity released the gases that formed the early atmosphere and water vapour that condensed to form the oceans. Some theories suggest that during this period, the Earth's atmosphere was mainly carbon dioxide and there would have been little or no oxygen gas (like the atmospheres of Mars and Venus today). There may also have been water vapour and small proportions of methane and ammonia.
Plants produced the oxygen that is now in the atmosphere.
Most of the carbon from the carbon dioxide in the air gradually became locked up in sedimentary rocks as carbonates and fossil fuels.
Release of carbon dioxide by burning fossil fuels increases the level of carbon dioxide in the atmosphere.

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