GLOSSARY OF TERMS

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This document contains all the definitions and chemical equations found in the MATSEC syllabus together with other terms which are encountered throughout the two year course for Intermediate Environmental Science.

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Definitions given in MATSEC syllabus (italics) and others

Subject Focus 1 – The atmosphere and atmospheric pollution

Atmospheric pollution: *the release of energy or matter into the atmosphere with the potential to cause adverse effects on human health and ecosystems.*

Atmospheric pollutant: *a substance or form of energy that when released into the atmosphere may (directly or indirectly) have adverse effects on human health and ecosystems.*

Subject Focus 2 – The hydrosphere and water pollution

Biological Oxygen Demand (BOD): *the amount of oxygen required by decomposers to break down organic biodegradable waste in aquatic environments.*

Evaporation: the process by which a liquid (e.g.: water) is heated by a source such as the sun or geothermal energy, and then change into an invisible vapour in the atmosphere (change of state: liquid to gas).

Transpiration: the process by which water vapour is lost from plant leaves.

Condensation: process by which water vapour changes into liquid water.

Precipitation: any or all of the forms of water particles, whether liquid or solid that fall from the atmosphere.

Interception: Precipitation which does not reach the soil but is instead stopped by the leaves, branches of plants and the forest floor.

Infiltration: the process by which water on the ground enters the soil.

Percolation: the process of a liquid moving slowly through a substance (e.g. rock) that has very small holes in it.

Run-off: water that flows away from high areas to low areas.

Subject Focus 3 – Biodiversity

Species: all organisms of the same kind that can breed in nature and produce fertile offspring**.**

Population: consists of all the members of a species living in a given area at the same time.

Community: (also known as biological community) all the populations of organisms living and interacting in a particular area.

Ecosystem: a geographic area where plants, animals and other organisms (biotic component) interact with each other and with the physical environment (abiotic component e.g. weather and landscape).

Ecotone: a border between two communities or biomes.

Biome: is a large geographic area characterized by specific climate, vegetation, and animal life, forming a major ecological community.

Trophic level: is a position an organism occupies within a food chain or web, representing its source of energy.

Restoration ecology: *the study of renewing a degraded, damaged, or destroyed ecosystems through active human intervention.*

Subject Focus 4 – Population dynamics and human populations

Population: *all the organisms of the same species that live in a specific area, at a given time, and can interbreed to produce fertile offspring.*

Biotic potential: *the maximum reproductive capacity of the population under optimum environmental conditions.*

Environmental resistance: *all those factors that limit population growth.*

Carrying capacity: *the maximum population size that an environment can support.*

Crude birth rate: *the number of annual live births per one thousand people.*

Crude death rate: *the number of annual deaths per one thousand people.*

Subject Focus 5 – Earth and the management of its resources

Sustainable development: *the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987).*

Agriculture: *the science and practice of cultivating the soil, growing crops, and raising livestock.*

Genetically modified organisms (GMOs): *an animal, plant, or microbe whose genetic material (DNA) has been altered using genetic engineering techniques to have certain desired traits.*

Sustainable harvesting: *the management of living resources to allow them to replenish and remain available for future generations.*

Energy: *the ability to do work.*

Carbon footprint: *the total amount of greenhouse gases released to the atmosphere as a result of anthropogenic activity (as exemplified by water and electricity bills).*

Biofuels: *energy resources that have been produced by biological processes sufficiently recently that they can be renewable (i.e.: rate of harvesting does not exceed the rate of production).*

Subject Focus 6 – Climate change

None

Chemical equations required by the MATSEC Syllabus

Subject Focus 1

Natural Ozone Formation in the Stratosphere:

$$O_2 \xrightarrow{\text{UV light}} 2O$$

$$O + O_2 \longrightarrow O_3 + \text{heat energy}$$

Natural Ozone Destruction in the Stratosphere:

$$O_3 \xrightarrow{\text{UV light}} O_2 + O$$

$$O + O_3 \longrightarrow 2O_2 + \text{heat energy}$$

Unpolluted rain – Formation of Carbonic acid:

$$H_2O + CO_2 \longrightarrow H_2CO_3$$

Acid Precipitation Formation:

$$SO_2 + H_2O \longrightarrow H_2SO_3$$

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

$$SO_3 + H_2O \longrightarrow H_2SO_4$$

$$2NO_2 + H_2O \longrightarrow HNO_3 + HNO_2$$

Anthropogenic Depletion of Stratospheric Ozone:

$$CFCs \xrightarrow{\text{UV light}} Cl \text{ atoms}$$

$$Cl + O_3 \longrightarrow ClO + O_2$$

$$ClO + O \longrightarrow Cl + O_2$$

Subject Focus 3

Photosynthesis:

$$6CO_2 + 6H_2O \xrightarrow{\text{Light energy}} C_6H_{12}O_6 + 6O_2$$

Respiration:

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

Other important terms and phrases used during lectures

This section is intended for ease of reference and includes brief meanings of terms and phrases, arranged in alphabetical order, used during lectures.

Subject Focus 1 – The atmosphere and atmospheric pollution

Acid precipitation: rain, snow, hail, fog or dew that has a low pH value resulting from the dissolution of pollutants in it.

Acid rain: rain which is made acidic as a result of atmospheric pollutants which dissolve in it.

Aerosols: small liquid droplets and particles which are found suspended in the atmosphere.

Albedo: the proportion of sunlight reflected by a surface, expressed as a percentage or a dimensionless value between 0 and 1.

Anthropogenic: caused by human activity.

Anthropogenic pollutant: a pollutant which is released as a result of an activity carried out by man (e.g. oxides of nitrogen released as a result of a combustion process).

Carbon dioxide: a colourless naturally occurring gas which is slightly denser than air. It is used by certain organisms during photosynthesis but is also a product of combustion and respiration. It is also considered as a major Greenhouse Gas.

Chemical equation: a symbolic representation of a chemical reaction in the form of symbols and formulae where the reactants are usually found on the left side and the products on the right side with an arrow from left to right showing the direction of the reaction.

Chlorofluorocarbons (CFCs): nontoxic, non-flammable chemicals containing carbon, chlorine and fluorine which were mostly used in aerosol sprays, as solvents and as refrigerants. They are major stratospheric ozone depleters apart from being GHGs.

Climate: general pattern of atmospheric conditions, seasonal variations and weather extremes in a region over a long period of time.

Compound: a substance which contains two or more elements chemically joined together.

Conduction (thermal)**:** the transfer of heat by microscopic collisions of particles within a body.

Convection: is the heat transfer due to bulk movement of molecules within fluids such as gases and liquids, including molten rock.

Convection current cells (Hadley cells/ Ferrel cells/Polar cells): when a volume of air is heated, it expands and becomes less dense, rises and cooler air descends to settle below it. Such a movement is called convection and the moving body of air is called a convection cell. These cells form at different latitudes of the earth, and starting from the equator to the poles are called Hadley, Ferrel and Polar cells.

Diffuse radiation: describes the rays of sun which have been scattered by molecules and particles in the atmosphere on their way to the earth's surface.

Diffuse source of pollution: also known as **Non-point source of pollution** is pollution which is usually the result of a variety of different sources or from an area, e.g. dust from soil erosion, strip mining, rock crushing and building construction sites.

Direct radiation: solar radiation travelling in a straight line from the sun down to the earth's surface.

Earth's radiation budget: this is the balance between the energy the Earth receives from the Sun and that which the earth radiates back into outer space after having been distributed throughout the earth's climate system.

Electromagnetic Spectrum (**EM**)**:** it is the range of frequencies of electromagnetic radiation and their respective wavelengths and energies.

Element: a substance which cannot be split up into two or more simpler substances by any known chemical process. It consists of one type of atom.

Equinox: this is the moment when the plane of the Earth's equator passes through the centre of the Sun; Occurs around the 20 March and the 22-23 September of each year. Day length = night length.

Flue gas denitrification: a process used to remove oxides of nitrogen from exhaust gases (flue gases) produced by combustion processes such as those in power plants and industrial facilities.

Flue gas desulfurization (FGD) : technology used to remove sulfur dioxide from exhaust flue gases of fossil-fuel power plants and other similar industrial processes working on coal or heavy fuel oil.

Gas: a state of matter in which particles (atoms or molecules) move in different directions and at various speeds; gases have neither a definite volume nor shape but will occupy all the space they are in.

Glacials: periods where most of the earth was covered in ice sheets.

Greenhouse effect: a natural effect caused by naturally occurring greenhouse gases (carbon dioxide, water vapour, methane, nitrous oxide and ozone) found in the troposphere. These gases are able to absorb long wavelength radiations emitted from the surface of the earth and re-radiate them back, thus contributing to the earth's temperature.

Group (Periodic Table): in chemistry, a Group is a column of elements in the periodic table. There are 18 numbered groups while a block of elements found between groups 3 and 12 are known as the Transition Elements.

Insolation: a measure of solar radiation energy received on a given surface in a given time.

Industrial smog (Classic smog or London smog): a type of air pollution primarily caused by the burning of high-sulfur coal and other fossil fuels in industrial areas.

Mesopause: interface (common boundary) between the mesosphere and the thermosphere.

Mesosphere: the layer of the atmosphere which lies directly above the Stratosphere and below the Thermosphere. The temperature in the Mesosphere decreases with altitude.

Milankovitch cycles: these cycles describe the collective effects of changes in the earth's movements on its climate over thousands of years.

Mobility: term used to describe the ability of various chemicals to travel through the environment (both airborne and aqueous).

Molecule: an electrically neutral group of two or more atoms held together by chemical bonds.

Natural pollutant: a harmful substance/ energy which is released from a natural source (e.g. methane released from ruminant animals).

Neutralization reaction: a reaction whereby an acid (H^+ ions) reacts with an equal quantity of a base (OH^- ions) to form a salt and water.

Ozone, O_3**:** a naturally occurring allotrope of oxygen which is less stable than O_2. It can be found both in the stratosphere and also in the troposphere where in the latter it forms mainly as a result of reactions resulting from the effect of the sun on a number of pollutants.

Ozone hole: excessive thinning of the ozone layer when more than half of the ozone gas in a particular area is depleted (forming the ozone hole) and harmful ultraviolet rays can pass through to reach the earth's surface.

Peroxyacetylnitrates (**PANs**)**:** pollutants found in photochemical smog which are chemically unstable and break down into nitrogen dioxide gas and peroxyethanoyl radicals.

Persistence: is when pollutants remain in the environment for a long time.

Persistent pollutants: chemicals which remain in the environment for a long time and so have a long residence time. Some of these could also **bioaccumulate** through the food web and as a result pose a risk by causing adverse effects to human health and the environment.

Photochemical oxidants: harmful compounds formed from nitrogen oxides and VOCs when exposed to sunlight.

Photolysis/ Photochemical degradation/ Photochemical dissociation: a chemical reaction in which molecules of a chemical element or compound are broken down by an electromagnetic wave (photons from either visible light, UV, IR, gamma, and x-rays).

pH scale: a measure used to determine whether a substance is an acid, alkali or neutral and its degree of acidity or alkalinity. The scale is 1-14.

Substances which have a high amount of H^+ ions in aqueous solution are **acidic**, (pH less than 7) those which have a high amount of OH^- ions are **alkaline,** (pH higher than 7) while those which have equal amounts of these two ions are **neutral** (pH 7).

Photochemical smog (**Los Angeles smog**)**:** a type of air pollution which is caused by reactions between sunlight and pollutants like hydrocarbons and nitrogen dioxide

Phytotoxicity: a term used to describe the toxic effect of a compound on plant/ tree growth. Such damage may be caused by a wide variety of compounds, including trace metals, pesticides, or salinity.

Point source of pollution: any single identifiable source of pollution from which pollutants are discharged e.g. a smoke stack or some other discharge point.

Precession: the change in the orientation of the rotational axis of a rotating body e.g. the earth.

Primary pollutants: are those pollutants which are released in the environment in a harmful form.

Secondary pollutants: are those pollutants (harmful substances) which become hazardous after reactions in the air. (e.g.: photochemical oxidants and atmospheric acids)

Smog: a kind of air pollution resulting from a mixture of smoke and fog. Can be either industrial or photochemical.

Solstice: an event occurring when the sun appears to reach its most northerly or southerly excursion relative to the equator. This results in the summer and winter solstices which occur around the 21st June and 21st December every year respectively, resulting in the longest and shortest day in the year.

Stationary source of pollution: one whereby the pollutant is released from a non-moving source (e.g. chimney on a factory).

Stratopause: interface (common boundary) between the stratosphere and the mesosphere.

Stratosphere: a layer of the atmosphere which is found just above the troposphere and below the mesosphere where the temperature increases with altitude. The ozone layer is found in this part of the atmosphere.

Stratospheric ozone: ozone formed and found in the Stratosphere.

Suspended particulate matter (SPM): anthropogenic and naturally occurring microscopic solid or liquid particles found suspended in the atmosphere.

Synergistic action: term used to describe a situation where the combined effect of a number of pollutants present together would be much greater than the effect resulting from the individual chemicals when present on their own.

Temperature inversion/ Thermal inversion: when a layer of warm air is above a ground layer of cold air.; the reversal of normal conditions, where, in the troposphere, temperature decreases with height.

Thermopause: atmospheric boundary of the earth's energy system found at the top of the thermosphere.

Thermosphere: layer of the atmosphere found above the mesosphere. Temperature in this layer increases with altitude.

Tropopause: interface (common boundary) between the troposphere and the stratosphere.

Troposphere: lowest layer of the earth's atmosphere where we live and where all weather conditions take place. Temperature decreases with altitude in this layer.

Visible spectrum: portion of the electromagnetic spectrum that is visible to the human eye.

Volatile organic compounds (VOCs): organic compounds (compounds of carbon and other elements) which are found in a vapour phase.

Weather: short-term change in temperature, pressure, humidity, cloud cover, wind direction and speed in the troposphere at a given place and time.

Word equation: a chemical reaction expressed in words rather than in chemical formulas.

Subject Focus 2 – The hydrosphere and water pollution

Aquifer: an aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt, or clay) from which groundwater can be usefully extracted using a water well.

Bioaccumulation: is the selective build-up of compounds in the bodies of living organisms. The effect from such compounds could be **biomagnified** when the concentration of such chemicals increases as they move up the food chain.

Biomagnification: also known as **Bioamplification** or **biological magnification**, is the increasing concentration of a substance, such as a toxic chemical, in the tissues of organisms at successively higher levels in a food chain.

Desalination plants: industrial equipment which uses a technology to remove salts from sea water, usually to produce potable water e.g. Reverse osmosis plants or distillation plants.

Evapotranspiration: a term used to describe the sum of evaporation and plant transpiration from the earth's land surface to the atmosphere. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapour through stomata in its leaves. Evapotranspiration is an important part of the water cycle.

First Class water/ Potable water: type of water which is fit for human consumption.

Groundwater: subterranean water held in cracks and pore spaces. Depending on the geology, the groundwater can flow to support streams. It can also be tapped by wells. Some groundwater is very old and may have been there for thousands of years.

Hydrologic cycle/ Water cycle: the sequence of conditions through which water passes from a vapour in the atmosphere to a liquid as rain precipitating on land or water surfaces and returning back into the atmosphere as a result of evaporation and transpiration.

Hydrosphere: combined mass of water found on, under and above the surface of the planet.

Liquid waste: can be defined as wastewater which could contain both hazardous and non-hazardous substances such as fats, oil, sludges etc. which are in the liquid form.

Mean sea level aquifer: a fresh water body found above a salt water body in the lower coralline limestone rock layer at sea level.

Oligotrophic environments: terrestrial and aquatic environments with very low productivity as a result of low nutrients such as nitrates, iron, phosphates and carbon.

Oxygen sag: refers to the reduction in dissolved oxygen plotted over a distance along a water body from a point at which sewage or other oxygen-consuming pollutants have been discharged.

Pathogen: an infectious agent (bacterium, fungus or virus) that can cause disease or illness to its host.

Perched aquifer: a body of water formed above an impermeable layer of rock (e.g. Blue clay layer) which prevents further infiltration downwards. Fresh water springs could form where these different layers of rocks are exposed.

Photodegradable materials: materials which are broken down into smaller pieces as a result of the action of sunlight.

Recharge zone: area where surface water filters into the aquifer.

Salinity: a measure of all the salts dissolved in water.

Second class water: water which is not suitable for human consumption but could be used for agricultural purposes mainly due to dissolved nutrients which it could contain.

Siltation: a process by which water becomes dirty/ murky/ cloudy/ turbid as a result of solid mineral particles suspended in the water.

Specific heat capacity (**SHC**) (symbol: c)**:** the quantity of heat energy required to raise the temperature of 1kg of substance by 1^0C (or by 1Kelvin, K).

Surface waters: water at the surface of the planet such as in a river, lake, wetland or ocean.

TBT: **tributyltin** which is a chemical found in antifouling paints used on ship hulls and other structures found in the sea to prevent the growth of marine organisms on the surface. The substance works by leaching out chemicals found in the paint and may eventually end up in the water and could affect other marine organisms such as mussels, clams and oysters.

Turbidity: a measure of the degree to which the water loses its transparency due to the presence of suspended particles.

Water table: the top layer of the zone of saturation or an aquifer.

Subject Focus 3 – Biodiversity

Abundance: refers to the number of individuals of a species in an area.

Alien species (Introduced Species, exotic species, or non-native species): a species that is not native to a specific location. If an alien species spreads to a degree believed to cause damage to the environment, human economy or human health, then it is considered to be an **Invasive Alien Species (IAS)**.

Biodiversity: the variety and variability of life on earth.

Biological community: all the populations of organisms living and interacting in a particular area**.**

Biomass: total mass of living organisms in a specific area (ecosystem) e.g. forest or ocean, in a given time.

Carnivore: an organism which relies on consuming animal flesh for its nutrition and energy.

Climax community: an ecological community in which populations of plants or animals remain stable and exist in balance with each other and their environment. It is the final stage of succession.

Competitive exclusion principle: states that no two species can occupy the same ecological niche for long. The one which is more efficient in using the available resources will exclude the other.

Core habitat: an environment which is large enough to sustain nearly all the plant and animal species that are typical of that environmental community.

Decomposers: organisms (mostly bacteria or fungi) which chemically break down dead and decaying material into simpler materials and in the process they get their energy, carbon and nutrients for growth and development.

Detrivores: also known as decomposers, are animals which feed on dead organisms and break them down into smaller molecules.

Detritus food chain: a food chain which begins with dead organic materials beginning broken down by decomposers (fungi and bacteria) which are in turn consumed by detrivores (e.g.: earthworms or snails) being subsequently consumed by their own predators.

Disturbance: any force which disrupts the established patterns of species diversity and abundance, community structure or community properties in a habitat.

Diversity: (sometimes referred to as **species richness**) number of different species per unit area.

Ecological niche: the role played by a species in a biological community and the total set of environmental factors that determine a species' distribution.

Ecological pyramid: a graphical representation designed to show the relationship between organisms in an ecosystem. Mostly shows the flow of energy and biomass or bio-productivity at each trophic level in a given ecosystem.

Ecological succession: the process of change in species structure of an ecological community over time.

Endemic species: species which are only found in a particular location or type of habitat and nowhere else.

Evolution: the change in the heritable characteristics of biological populations over successive generations.

Food chain: the sequence of transfers of matter and energy in the form of food from organism to organism.

Food web: a system of interlocking and interdependent food chains.

Fundamental niche: the fundamental niche of a species includes the total range of environmental conditions that are suitable for its existence without the influence of interspecific competition or predation from other species.

Generalist species: a species which is able to thrive in a wide variety of environmental conditions and can make use of a variety of resources (wide niche).

Grazer food chain: a food chain which begins with an autotrophic producer.

Habitat: a place or set of environmental conditions in which a particular organism lives.

Habitat specialists: organisms which have particular habitat requirements, usually having low reproductive rates and care for their young.

Herbivores: organisms which are adapted to consume vegetation as their main source of energy.

Indigenous species: species which are native or naturally belonging to a particular geographic location or environment.

Interspecific competition: competition between members of different species.

Intraspecific competition: competition amongst members of the same species.

Keystone species: a species which has a disproportionate effect on its environment relative to its abundance, affecting many other organisms in an ecosystem and helps to determine the types and numbers of various other species in the community.

Less Economically Developed Countries (LEDCs): countries which are highly vulnerable to economic and environmental shock and have a low level of human assets.

Lindeman's Ten Percent Law: states that only 10% of the energy that enters a trophic level is converted into biomass and passed on to the next trophic level.

Mutualism: symbiotic relationship between different species that is of benefit to both.

Native species: plants and animals that originated and live in an area without any human intervention.

Nucleus: in biology, it is a membrane-bound organelle found in eukaryotic cells.

Omnivore: organism which eats both plants and flesh.

Parasitism: a form of symbiosis whereby one organism, the parasite lives on (ecto-parasite) or in (endo-parasite) another organism, the host, causing it some harm and is adapted structurally to this way of life.

Pioneer community: a community that is made up of all the living organisms that occupy an area undergoing primary succession in the initial stages.

Pioneer species: a species which colonizes previously uncolonized land, usually leading to an ecological succession.

Predation: a biological interaction where one organism, the predator, kills and eats another organism, its prey.

Primary consumers: organisms which are adapted to feed on primary producers the latter being organisms which acquire their energy needs from sunlight and materials from non-living sources.

Primary productivity: rate at which light (solar) energy is converted by photosynthetic autotrophs to energy stored in bonds of organic substances.

Primary succession: organisms start inhabiting new areas of land, which could be both natural or artificial surfaces.

Producers: organisms which make their own food; they are also known as autotrophs.

Productivity: the amount of biomass (biological material) produced in a given time.

Pyramid of biomass: depicts the biomass of the members of the food chain present at any one time at each trophic level.

Pyramid of energy/ Pyramid of productivity: depicts the total amount of energy present at each trophic level, as well as the loss of energy between trophic levels.
Pyramid of numbers: depicts the number of individual organisms at different trophic levels of a food chain.

Realized niche: the realized niche describes that part of the fundamental niche actually occupied by the species.

Recruitment: in biology, especially marine biology, recruitment occurs when juvenile organisms survive to be added to a population, by birth or immigration, usually a stage whereby the organisms are settled and able to be detected by an observer.

Resilience: the capacity of an ecosystem to respond to a disturbance or to withstand ongoing pressures maintaining its basic structure, function and processes.

Resistance: the property of communities or populations to remain "essentially unchanged" when subject to disturbance.

S-curve: a sigmoidal shaped graph depicting logistic growth.

Scavengers: organisms which feed on both dead animal and plant material present in their habitat.

Secondary consumer: an organism (carnivore or omnivore) which eats flesh (herbivores that eat producers).

Secondary productivity: manufacture of biomass by organisms which consume plants.

Secondary succession: the response of living organisms and the ecosystem to environmental disturbance.

Sere: a **seral community** or sere is an intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Specialist species: a species which can thrive only in a narrow range of environmental conditions or has a limited diet (narrow niche).

Species diversity: number of different species that are represented in a given community.

Symbiosis: a process whereby two or more species live intimately together, most often to the benefit of all partners.

Subject Focus 4 – Population dynamics and human populations

Demographic transition model (DTM): a model describing the transition of the human population in a country or region from pre-industrial to an industrialized economic system.

Demography: the statistical study of populations especially human beings.

Emigration: the movement of people/ organisms out of a country or area.

Exponential growth: population growing by a constant percentage per unit time and is represented by a J-shaped curve.

Immigration: the movement of people/ organisms into a country or area.

Internal migration: the movement of people/ organisms within a country/ area;

International migration: the movement of people/ organisms across a national border, from one country to another.

Linear population growth: population growth is directly proportional with time (e.g.: population: 20, 40, 60, 80; day 2, 4, 6, 8).

Logistic/sigmoidal growth: exponential growth rate followed by a per capita growth rate which gets smaller and smaller as the population size approaches a maximum imposed by limited resources in the environment, known as carrying capacity. Sigmoidal population growth curves have the shape of an S.

Malthusian population growth / irruptive population growth: population growth showing a rapid increase in numbers followed by a sharp decrease as resources become scarce.

More Economically Developed Countries (MEDCs): countries which have a developed economy and advanced technological infrastructure relative to other less industrialized nations.

Mortality rate or Crude[1] death rate: the number of deaths per 1000 persons in a given year. Doesn't take into consideration reasons of death.

Natality rate or Crude[1] birth rate: the number of births per 1000 persons in a given year.

- Most widely reported measure of fertility;
- It depends strongly on the age structure of the population- CBR will tend to be higher in a population having younger women.

Net migration: the difference between the number of people/ organisms moving into and out of a country or area.

[1] Called CRUDE because it does not take into account age or sex differences among the population.

Overshoot: in population ecology, overshoot occurs when a population temporarily exceeds the long term carrying capacity of its environment.

Population crash/ dieback: a sudden decrease in individual members of a population, following an overshoot.

Subject Focus 5 – Earth and the management of its resources

Abiotic: non-living; physical factors.

Aerobic conditions: conditions where oxygen is present.

Aerobic respiration: the process by which oxygen is used by an organism in order to break down chemical substances (usually sugars) and obtain energy which is used by the organism to perform different tasks.

Afforestation: a process of planting trees or sowing seeds in a barren land devoid of any trees to create a forest.

Alternative sources of energy: any source of energy which is an alternative to fossil fuels.

Anaerobic conditions: conditions where oxygen is absent.

Anaerobic respiration: the process by which an organism uses substances other than oxygen in order to break down chemical substances (usually sugars) and obtain energy which is used by the organism to perform different tasks.

Asthenosphere: a viscous layer of solid rock found under the lithosphere and forming part of the upper mantle.

Atom: the smallest constituent of ordinary matter. A simple representation of an **atom** would consist of a central nucleus made up of a number of protons and neutrons surrounded by a number of electrons orbiting that nucleus. These electrons are arranged in orbitals and shells around the nucleus.

Atomic nucleus: a small dense region consisting of protons and neutrons found at the centre of an atom.

Autotrophs: organisms which produce complex organic compounds from simple inorganic materials using energy from sunlight (photosynthesis) or inorganic chemical reactions (chemosynthesis).

Biodegradable materials: materials which are decomposed as a result of the action of organisms, including micro-organisms.

Biogenic sediment: represents a range of sediment types, all of which are essentially the fossil remains of former living organisms.

Biogenic sedimentation: sediments formed from at least 30% skeletal remains of marine organisms together with other deposits arising from other sources.

Biogeochemical cycles: natural pathways by which essential elements of living matter are circulated through biotic (living) and abiotic (non living) compartments of the earth.

Biological pest control: a process where one uses other organisms (predators) to control pests (prey) which attack plants or other species.

Biological weathering: weakening and subsequent degradation of rock by plants, animals and microscopic organisms.

Biomass: waste material from plants or animals that is not used for food or feed.

Biotic: living; biological factors.

Carbohydrate: carbohydrates are the sugars, starches and fibres found in fruits, grains, vegetables and milk products.

Carbon sink: a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period of time.

Carcinogenic substances: substances which could cause cancer.

Cell: it is the smallest unit of life and is considered as the basic, structural, functional and biological unit of all known living organisms.

Chemical energy: a form of potential energy stored in the bonds of chemicals.

Chemical weathering: takes place due to the selective removal of minerals from the rock by chemical agents (e.g. acid rain) leading to its weakening.

Chlorophyll: a pigment which is found in cyanobacteria and plants giving them the green colour. It is essential in photosynthesis allowing plants to absorb energy from light.

Chromosome: a thread-like structure of nucleic acids (DNA) and protein found in the nucleus of most living cells, carrying genetic information in the form of genes.

Combustion reaction: this reaction usually occurs when a combustible material (usually a hydrocarbon) reacts with oxygen.

Composting: the process by which biodegradable material is turned into rich compost by means of organisms (micro and macro) which would be feeding on it.

Conservative boundaries: at conservative boundaries, two plates move past each other in opposite directions.

Contour ploughing or **contour farming:** a farming practice of ploughing across a slope following its contours.

Convergent boundaries: these are associated with the convergence of plates. Two plates moving towards one another, pushed under great pressure. One of the plates usually overrides the other, with the overriding plate forcing the other plate to dip downwards. This process is known as **subduction**.

Crop rotation: an agricultural practice of growing a series of dissimilar or different crops in the same area in sequenced seasons.

Crust: the earth's crust is the outermost layer of the earth and is made up of different types of rocks namely,sedimentary, metamorphic and igneous.

Decay: the decomposition of organic matter by micro-organisms.

Decomposition: the breakdown of organic material by organisms either aerobically or anaerobically.

Deforestation: removal or clearing of a forest or stand of trees where the land is thereafter converted to a non-forest use.

Denitrification: a microbiologically facilitated process whereby nitrates are reduced to nitrogen gas.

Denitrifying bacteria: a group of bacteria which are able to complete the denitrification part of the nitrogen cycle converting nitrates into nitrogen gas and some nitrous oxide.

Desertification: the process which turns productive land into non-productive desert as a result of poor land-management.

Divergent boundaries: these are associated with divergence of plates. Two plates move apart and new material emerges from the mantle.

Drainage: soil drainage is a process by which water moves across or through the soil as a result of the force of gravity.

Dump: site for depositing rubbish.

Electron: an electron is a sub-atomic particle which has a negative charge and a negligible mass. Electrons are found in the orbitals (shells) of atoms around the nucleus.

Eluviation: a process by which rain moves fine particles (e.g. minerals, clay, organic material) from upper soil layers to deeper ones.

Encapsulation: a process by which waste material which is usually toxic or hazardous is placed in drums and then covered with concrete.

Engineered landfill: an area used for the disposal of waste which is completely sealed from the surrounding land and which is managed in such a manner so as to manage to collect any liquids and gases which are emitted from the waste buried in it.

Eutrophic environments: aquatic environments which are rich in nutrients such as nitrates, phosphates and organic substances and so support high productivity especially algae.

Eutrophication: a process by which particular pollutants are washed into a water body and overload it with organic and mineral nutrients causing excessive algal growth and oxygen depletion in the water.

Extrusive rock: magma from volcanic activity which exits the earth's crust, cools quickly to form fine crystalline structures**.**

Fault (geological)**:** a large crack (planar fracture or discontinuity) found in the earth's crust where compressional or tensional forces cause relative displacement of the rocks.

Fertilizer: a natural or synthetic material which is usually applied to soils as supplement for plant growth.

Fission: when a large atom of one element is split to produce two smaller atoms of different elements.

Freeze-thaw weathering: a form of mechanical weathering. Occurs mainly as a result of changes in temperature (day /night) whereby water found in cracks in the rocks freezes, expands and cracks the rocks.

Fungicides: chemicals or biological organisms used to kill parasitic fungi or their spores.

Fusion: when two small atoms combine to form a large atom of a different element.

Gamma radiation: usually accompanies alpha and beta emission whereby excess energy remaining in the nucleus is usually emitted in the form of gamma radiation.

Gene: the hereditary unit of information which occupies a specific position on a chromosome.

Grazing: a method of feeding in which a herbivore feeds on plants such as grasses or other multicellular organisms such as algae.

Green manure: naturally produced fertilizer and mulch resulting by leaving uprooted or parts of sown crops to wither on a field.

Gullying/ Gully erosion: the process whereby soil is carried away as a result of heavy downpours forming large wide canals (gullies) from where the water flows through.

Hazardous substance: a hazardous substance is one that poses a level of threat to life, health, property, or environment.

Heat: describes the energy which can be transferred (by conduction, convection or radiation) between objects at different temperatures.

Herbicides: also known as weed killers are chemicals which are used to kill/ control unwanted plants.

Heterotrophs: organisms that require organic substrate to get their carbon for growth and development. Heterotrophs are the primary consumers in food chains.

Igneous Rocks: this type of rock is formed from the solidification of hot, molten magma or lava.

Illuviation: the deposition of fine particles of material originating from an upper layer of soil down to a deeper soil layer.

Incineration: a waste treatment process that involves the combustion of organic substances contained in waste materials. Also known as thermal treatment of waste.

Infrared radiation (IR)**:** region of the electromagnetic radiation spectrum where wavelengths range from 700nm to 1 mm. IR waves have longer wavelengths than those of visible light but shorter than those of radio waves.

Inner core: the earth's inner core is the innermost part of the earth consisting mainly of iron and nickel and is in a solid state mainly due to the very high pressures found here albeit the temperatures are also the highest found in the interior part of the earth.

Inorganic compounds: all chemical compounds which do not contain carbon with the exception of carbon dioxide, carbon monoxide, carbonates ($-CO_3^{2-}$), and hydrogen carbonates ($-HCO_3^-$).

Insecticides: chemical substances which are used to kill insects, their larvae or eggs.

Intensive agricultural practices: agricultural practices whose principal aims are those to maximize yields from the available land through various means such as the heavy use of pesticides and chemical fertilizers.

Ion: an atom or molecule which has an electrical charge due to loss or gain of electrons.

Isotopes: atoms of the same element having different number of neutrons and so a different atomic mass but same number of protons, hence showing similar chemical properties.

Joule: 1 joule is the energy transferred to an object when a force of one newton acts on that object in the direction of its motion through a distance of 1 metre. The joule (J) is also the standard unit (SI) of energy, work or heat.

Landfill: a concave shaped area used to deposit rubbish/ waste.

Landrise: an area above the ground where rubbish is deposited to form a large heap.

Leaching: the loss of water soluble substances from other materials found in a medium, such as rock or soil. (This material often ends up in a water body such as an aquifer, lake or sea).

Liquid: a state of matter in which particles (atoms or molecules) are further spaced apart and vibrate more than in the case of a solid; liquids take the shape of the container they are in.

Lithosphere: the rigid outer part of the earth consisting of the crust and upper mantle.

Lithospheric plates (crustal plates)**:** regions of the earth's crust and upper mantle that are fractured into plates that move with respect to each other.

Logging: a process by which trees are cut down for forest management and/or timber harvest.

Mantle: the mantle is a viscous-solid layer found between the outercore and the crust of the earth. The convectional movements which occur in this layer are thought to be responsible for the movement of the plates above.

Matter: made up of particles called atoms and/or molecules.

Mechanical weathering / Physical weathering: the physical break-up of rocks into smaller particles without any changes in their chemical composition.

Messinian salinity crisis: period during which most of the Mediterranean dried up.

Metamorphic rocks: These are formed following the warping and recrystallization of other rock resulting from high heat and pressure. This process is known as **Metamorphism.**

Methane: simplest hydrocarbon gas which is flammable, used as a fuel and also is a powerful greenhouse gas.

Mineral: a naturally occurring, inorganic solid with a specific chemical composition and a specific internal crystal structure.

Monocropping: an agricultural system whereby the same crop is planted during successive years on the same field.

Mulch: a layer of organic material which is applied at the surface of the soil in order amongst other things to retain soil moisture, improve fertility and reduce weed growth.

Multicropping: the practice used in agriculture of growing two or more crops in the same piece of land during the same season.

Mutagenic substances: substances that affect the DNA of organisms hence leading to the mutation of cells and cancer.

Mutation: a permanent alteration of the genetic sequence.

Neutron: a sub-atomic particle found in the nuclei of all atoms (except in the most common isotope of hydrogen) which has the same mass of a proton but without an electric charge.

Nitrification: is the biological oxidation (by bacteria) of ammonia or ammonium salts to nitrite followed by the oxidation of nitrite to nitrate.

Nitrifying bacteria: type of bacteria (*Nitrosomonas, Nitrosococcus, Nitrobacter, Nitrococcus* etc.) which are able to get their energy needs by the oxidation of inorganic nitrogen compounds. Usually found in the nitrifying steps (ammonia to nitrite and nitrite to nitrate) of the nitrogen cycle: a biogeochemical cycle by which nitrogen is converted into multiple chemical forms as it circulates among atmosphere, terrestrial and marine ecosystems.

Nitrogen fixing: natural nitrogen fixation is a process by which nitrogen in the earth's atmosphere is converted into ammonia or related nitrogenous compounds. This can take place naturally by lightning and also by bacteria in the soil or found in root nodules and also industrially in the production of ammonia.

Nitrogen fixing bacteria: bacteria which could be found both living freely and also in symbiotic relationship in roots of leguminous plants (legumes) which are responsible to fix atmospheric nitrogen gas.

Nitrous oxide: one of the gases which is produced and released during the denitrification of nitrate to nitrogen gas; is also a greenhouse gas and an ozone–depleting substance.

Non-renewable energy: energy derived from sources that will run out or will not be replenished in our lifetimes.

Nuclear energy: energy stored in the nucleus of an atom.

Nuclear fission: an atom of uranium (nuclear fuel) absorbs a neutron to split up into two smaller atoms and releases one to three neutrons, liberating enormous amounts of energy in the form of heat and radiation in the process.

Nuclear fusion: a reaction in which two or more atomic nuclei are combined to form one or more different atomic nuclei and subatomic particles. The differences in mass between the reactants and products results as either the release or absorption of energy.

Nutrient holding capacity/ Ion holding capacity: soils which are in a position to hold more water are less subject to leaching out nutrients and so have a high nutrient holding capacity.

Onion skin weathering or **exfoliation:** a form of mechanical weathering. This is mainly due to rapid day/night temperature changes in the rock causing it to expand and contract leaving it with a peel-like skin structure.

Organic compounds: all carbon containing compounds with the exception of carbonates ($-CO_3^{2-}$), hydrogen carbonate ($-HCO_3^-$), carbon dioxide and carbon monoxide.

Organic farming: a form of agriculture that relies on techniques such as crop rotation, green manure, compost and biological pest control.

Outer core: the outer core is a fluid layer found between the inner core and the mantle. It is made up of iron and nickel and is thought to be responsible for the earth's magnetic field.

Overgrazing: a process which occurs when plants are exposed to intensive grazing (eating of plants by animals) for extended periods of time or without sufficient recovery periods leading to the possibility of the land becoming susceptible to erosive processes.

Period (Periodic Table): a period in the periodic table is represented by each horizontal row.

Periodic table of elements: is a tabular arrangement of the chemical elements ordered by their atomic number, electronic configuration and chemical properties. The elements in the columns are known as groups while those in the rows are known as periods.

Pesticides: chemicals (could be anthropogenic or natural) used to kill pests found in the environment.

Photosynthesis: a process used mainly by green plants to produce sugars from carbon dioxide and water in the presence of sunlight. Oxygen gas is also produced as a by-product.

Photovoltaic panels/ PV panels: a device which is made up of hundreds of photovoltaic cells which are able to absorb solar radiation and convert it to an electric current.

Plate tectonic theory: the theory which explains the movements of the geological plates across the surface of the earth.

Potential energy: the energy stored in an object (Units: Joule, J).

Proton: a sub-atomic particle found in the nuclei of all atoms which has approximately the same mass of a neutron and has a positive charge which is equal but opposite to that of an electron.

Radiation: is the transmission or emission of energy in the form of waves or particles through space or through a material medium.

Radioactive decay/ Nuclear decay/ Radioactivity: the process by which an unstable atomic nucleus loses energy by emitting radiation such as alpha particles, beta particles or gamma radiation.

Rainsplash/ Splash erosion: the direct impact of raindrops on the soil causing soil to be displaced or removed.

RDF: Refuse Derived Fuel: waste which is used as a source of fuel.

Recycling: the reprocessing of materials into new products.

Reduced ploughing or **No-till farming:** a kind of conservation tillage system and is sometimes called **zero tillage**. It is a way of growing crops from year to year without disturbing the soil through tillage.

Reforestation: process of restoring forests on lands where they previously existed but were damaged or destroyed, typically through deforestation, clearcutting, or wildfires.

Renewable energy: energy that is collected from renewable resources which are naturally replenished on a human timescale.

Resource substitution: when one resource is replaced with another in order to achieve a more ecologically friendly outcome. E.g.: cardboard packaging instead of polystyrene (jablo).

Respiration: a process associated with living organisms, involving the breakdown of organic substances (mostly sugars or fats) in order to obtain energy (which is used by the organisms) and carbon dioxide (which is usually released). Respiration may be aerobic or anaerobic.

Reusing: the process of utilizing the same object or material once again without having to reprocess the material.

Ridge: a ridge is a geological feature consisting of a chain of mountains that form a continuous elevated crest for some distance.

Rift: in geology, a rift is a linear zone where the lithosphere is being pulled apart.

Ring of Fire: a major area in the basin of the Pacific Ocean where many earthquakes and volcanic eruptions occur.

Riparian zone: interface between land and a river or stream.

Rock: a solid, cohesive aggregate of one or more minerals. One could find different minerals in one piece of rock.

Rock stratum (pl.strata)**:** a stratum is a layer of sedimentary rock or igneous rock that was formed at the earth's surface and has consistent internal characteristics that distinguish it from other layers.

Salinization: the process taking place in the soil whereby dissolved inorganic minerals end up at the surface of the soil, accumulating by time, leaving the soil saltier every time it rains.

Seafloor spreading: a process that occurs at mid-ocean ridges, where new oceanic crust is formed through volcanic activity and then moves away from the ridge.

Sedimentary rocks: this type of rock forms from loose grains of other rocks which are consolidated by time and pressure.

Sedimentation: process during which particles of rock loosened from weathering processes are transported downhill and come to rest in a new area.

Separation at source: waste which is separated according to its composition at the place where it is generated.

Slash and Burn agriculture: when farmers cut down trees and vegetation (usually in a forest area) and burn them on site to clear the land and then use it for agricultural purposes.

Soil texture: refers to the degree of coarseness of soil.

Solar energy: the energy which reaches the earth from the sun.

Solar water heater: device which uses solar energy which is trapped beneath a glass cover in order to heat water.

Solid: a state of matter in which particles (atoms or molecules) are found very close to one another and cannot be compressed; solids have a definite shape.

Solid waste: any type of waste which is produced in the solid or semi-solid form.

Strip farming / Strip cropping: alternates strips of closely sown crops such as hay, wheat, or other small grains with strips of row crops, such as corn, soybeans, cotton, or sugar beets.

Subduction: a geological process which takes place at convergent plate boundaries where one plate moves under another and is forced or sinks due to gravity into the mantle.

Subduction zone: areas defined by the movement of geological plates moving under one another.

Terracing: involves shaping the land to create shelves of earth to hold water and soil. Soil is also held by rubble walls or trees at the edge of each shelf.

Terrestrial biosphere: that part of the earth system comprising all ecosystems and living organisms found on land.

Tidal energy: a form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity**.**

Toxic substance: a chemical which is considered to be harmful to health or lethal if consumed or otherwise entering the body in sufficient quantities.

Traditional agricultural practices: agricultural practices which use traditional means and so respect the natural regeneration of the land and are in synchrony with the natural timeframes.

Trench: usually associated with convergent plate boundaries resulting in the formation of narrow but very long depressions of the sea floor.

Tsunami: a series of ocean waves caused by the displacement of a large volume of water resulting from seismic activity in the oceans, volcanic eruptions, landslides or other major disturbances in a body of water.

Ultra violet radiation: region of the electromagnetic radiation spectrum where wavelengths range from 10nm to 400nm, shorter than that of visible light but longer than X-rays.

Waste management hierarchy: the correct sequence of how waste should be managed that is, **Reduce** waste, **Reuse** waste, **Recycle** waste, **Recover** waste and **Dispose** waste.

Waste streams: flows of specific waste, from its source through recovery, recycling or disposal.

Water holding capacity: the total amount of water a soil can hold.

Waterlogging: is when the soil becomes saturated with water and thus results in no air spaces left in the soil, thus leading to anaerobic conditions.

Wave energy: a source of renewable energy which uses a machine to exploit wave power and converts it to electrical energy.

Weathering: the process by which rocks which are exposed to air, water, changes in temperature and reactive chemical agents or biological agents such as roots are broken down into smaller particles.

Wind energy: a form of renewable energy which generates electrical energy from the movement of wind turbines resulting from the air flow over these structures.

Windbreak or **shelterbelt:** a plantation usually made up of one or more rows of trees or shrubs planted in such a manner as to provide shelter from the wind and to protect soil from erosion.

Subject Focus 6 – Climate change

Agenda 30: a global plan adopted by the United Nations in 2015. It outlines 17 Sustainable Development Goals (SDGs) aimed at achieving peace and prosperity for people and the planet by 2030. These goals address various global challenges, including poverty, hunger, inequality, climate change, and environmental degradation.

Enhanced greenhouse effect: strengthening of the naturally occurring greenhouse effect through human activities.

Environment Protection Act: legislation used as the legal document to provide protection to the environment in Malta.

Global warming: long-term rise in the average temperature of the earth's climate system.

Greenhouse gases (GHGs): gases which could be naturally occurring or man-made and which absorb and emit radiant energy within the thermal infrared range.

Heat sink: the ocean is a major heat sink since it absorbs a lot of heat as a result of conduction and loses it by means of radiation and to a lesser extent by conduction with the air above it.

Inter-glacials: periods of warmer weather between glacial periods.

IPCC: International Panel on Climate Change.

Kyoto Protocol: an international treaty which extends the United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions based on scientific consensus that (part one) global warming is occurring and (part two) it is likely that human-induced carbon dioxide emissions have caused it.

Mobile source of pollution: one where the source is in motion (e.g. a car, ship, boat etc.).

Ozone precursors: compounds which participate in a chemical reaction producing ozone as one of the products.

Vegetation belts: distinctive types of vegetation which is found growing in a particular area on the planet mainly due to the particular climatic conditions (depending on the latitude) found over there.